KEY SKILLS TRAINING LEVEL 2

mathsquad

-skill development-

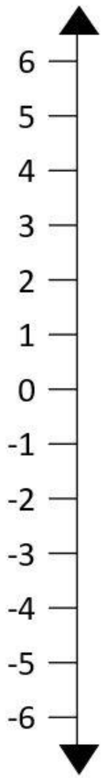
Contents

I adding and subtracting positive integers

Questions Part 1 of 3 – Adding Positive Numbers Using a Number Line

1.1 Calculate the following using a number line on the right to assist your calculation.

a.	$^-4 + 3$	b.	$^-2 + 5$	c.	$^-2 + 7$	d.	$^-5 + 3$
e.	$^-2 + 2$	f.	$^-1 + 4$	g.	$^-4 + 6$	h.	$^-5 + 0$
i.	$^-2 + 6$	j.	$^-4 + 1$	k.	$^-3 + 6$	l.	$^-3 + 2$
m.	$^-2 + 3$	n.	$^-5 + 7$	o.	$^-3 + 5$	p.	$^-1 + 2$
q.	$^-4 + 4$	r.	$^-6 + 3$	s.	$^-6 + 1$	t.	$^-2 + 1$



Answers

a. -1 b. 3 c. 5 d. -2 e. 0 f. 3 g. 2 h. -5 i. -5 k. 4 j. -3 k. 3 l. -1 m. 1 n. 2 o. 2 p. 1 q. 0 r. 3 s. -5 t. -1

Helpful Information

Strategy – Adding and Subtracting Positive Numbers using a Number Line

1. Put your finger (or pen tip) on the first number

2. Then

a. If adding a positive number move in the positive direction ↑

b. If subtracting a positive number move in the negative direction ↓

Examples

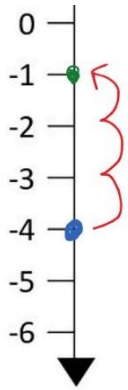
Question: Calculate $^-4 + 3$ using a number line on the right to assist your calculation.

Thought process: Using the above strategy we…

1. Start at -4

2. Move 3 in the positive direction ↑

Answer: -1



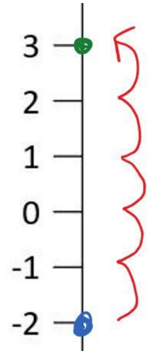
Question: Calculate $^-2 + 5$ using a number line on the right to assist your calculation.

Thought process: Using the above strategy we…

1. Start at -2

2. Move 5 in the positive direction ↑

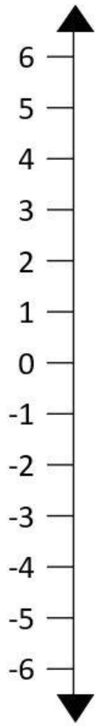
Answer: 3



Questions Part 2 of 3 – Subtracting Positive Numbers Using a Number Line

1.2 Calculate the following using a number line on the right to assist your calculation.

a. $^{-}3-2$	b. $2-3$	c. $4-6$	d. $^{-}1-3$
e. $^{-}1-4$	f. $^{-}2-2$	g. $^{-}1-3$	h. $6-6$
i. $0-5$	j. $^{-}1-4$	k. $6-2$	l. $1-4$
m. $3-3$	n. $1-3$	o. $^{-}2-3$	p. $3-2$
q. $^{-}5-1$	r. $^{-}3-3$	s. $2-1$	t. $^{-}4-1$



Answers

a. -5 b. -1 c. -2 d. -4 e. -5 f. -5 g. -4 h. 0 i. -5 j. -5 k. 4 l. -3 m. 0 n. -2 o. -5 p. 1 q. -6 r. -6 s. 1 t. -5

Helpful Information

Strategy – Adding and Subtracting Positive Numbers using a Number Line

1. Put your finger (or pen tip) on the first number

2. Then

a. If adding a positive number move in the positive direction ↑

b. If subtracting a positive number move in the negative direction ↓

Examples

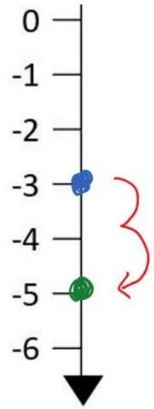
Question: Calculate $^{-}3-2$ using a number line on the right to assist your calculation.

Thought process: Using the above strategy we…

1. Start at -3

2. Move 2 in the negative direction ↓

Answer: -5



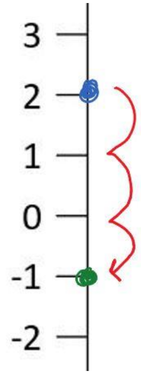
Question: Calculate $2-3$ using a number line on the right to assist your calculation.

Thought process: Using the above strategy we…

1. Start at 2

2. Move 3 in the negative direction ↓

Answer: -1



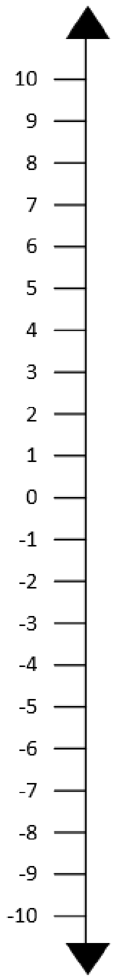
Questions Part 3 of 3 – Adding and Subtracting Positive Numbers Using a Number Line **1.3** Calculate the following using a number line to assist your calculation. Complete the following additions and subtractions. a. $1-5$ b. $^{-}2-1$ c. $^{-}3+2$ d. $^{-}2+3$ e. $^{-}2+5$ f. $^{-}5+2$ g. $0-1$ h. $^{-}6+2$ i. $^{-}2-2$ j. $^{-}1+0$ k. $3-3$ l. $3-1$ m. $^{-}2-4$ n. $^{-}1-3$ o. $6-1$ p. $^{-}4+3$ q. $^{-}6+4$ r. $^{-}5+2$ s. $1-2$ t. $^{-}1+1$ *Answers* a. -4 b. -3 c. -1 d. 1 e. 3 f. -3 g. -1 h. -4 i. -4 j. -1 k. 0 l. 2 m. -6 n. -4 o. 5 p. -1 q. -2 r. -3 s. -1 t. 0	

2 adding and subtracting negative integers

Questions Part 1 of 3 – Adding negative integers

2.1 Complete the following additions.

a. $2 + {}^{-}5$	b. ${}^{-}3 + {}^{-}2$	c. $1 + {}^{-}3$	d. $4 + {}^{-}3$
e. $0 + {}^{-}5$	f. $7 + {}^{-}3$	g. ${}^{-}4 + {}^{-}5$	h. ${}^{-}5 + {}^{-}1$
i. $5 + {}^{-}3$	j. ${}^{-}2 + {}^{-}6$	k. $5 + {}^{-}5$	l. ${}^{-}6 + {}^{-}5$
m. $1 + {}^{-}2$	n. $0 + {}^{-}2$	o. $5 + {}^{-}6$	p. ${}^{-}4 + {}^{-}2$
q. ${}^{-}5 + {}^{-}4$	r. ${}^{-}6 + {}^{-}1$	s. $2 + {}^{-}6$	t. $0 + {}^{-}6$



Answers

a. -3 b. -5 c. -2 d. 1 e. -5 f. 4 g. -9 h. -6 i. 2 j. -8 k. 0 l. -11 m. -1 n. -2 o. -1 p. -6 q. -9 r. -7 s. -4 t. -6

Helpful Information

Strategy – Adding and Subtracting Negative Numbers using a Number Line

1. Put your finger (or pen tip) on the first number

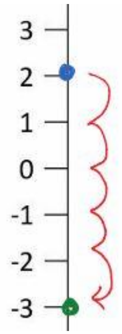
2. Then

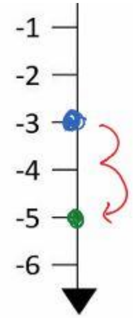
a. If adding a negative number move in the negative direction ↓

b. If subtracting a negative number move in the positive direction ↑

Examples

Question: Calculate $2 + {}^{-}5$ using a number line on the right to assist your calculation. **Thought process:** Using the above strategy we… 1. Start at 2 2. Move 5 in the negative direction ↓ **Answer:** -3	**Question:** Calculate ${}^{-}3 + {}^{-}2$ using a number line on the right to assist your calculation. **Thought process** Using the above strategy we… 1. Start at -3 2. Move 2 in the negative direction ↓ **Answer:** -5

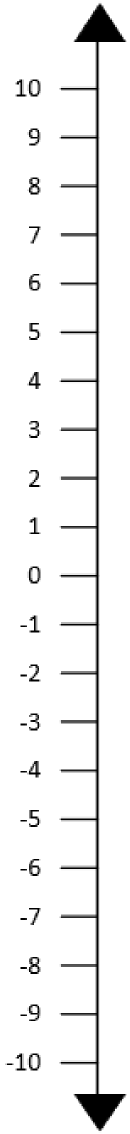




Questions Part 2 of 3 – Subtracting negative integers

2.2 Complete the following.

a. $^{-}5 - {}^{-}2$	b. $2 - {}^{-}4$	c. $0 - {}^{-}4$	d. $^{-}3 - {}^{-}1$
e. $^{-}3 - {}^{-}5$	f. $^{-}5 - {}^{-}5$	g. $^{-}6 - {}^{-}1$	h. $4 - {}^{-}3$
i. $^{-}6 - {}^{-}4$	j. $^{-}1 - {}^{-}4$	k. $^{-}6 - {}^{-}5$	l. $2 - {}^{-}5$
m. $6 - {}^{-}1$	n. $^{-}5 - {}^{-}3$	o. $^{-}2 - {}^{-}3$	p. $1 - {}^{-}4$
q. $4 - {}^{-}1$	r. $^{-}4 - {}^{-}1$	s. $^{-}4 - {}^{-}4$	t. $^{-}2 - {}^{-}1$



Answers

a. -3 b. 6 c. 4 d. -2 e. 2 f. 0 g. -5 h. 7 i. -2 j. 3 k. -1 l. 7 m. 7 n. -2 o. 1 p. 5 q. 5 r. -3 s. 0 t. -1

Helpful Information

Strategy – Adding and Subtracting Negative Numbers using a Number Line

1. Put your finger (or pen tip) on the first number

2. Then

a. If adding a negative number move in the negative direction ↓

b. If subtracting a negative number move in the positive direction ↑

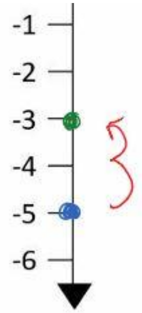
Examples

Question: Calculate $^{-}5 - {}^{-}2$ using a number line on the right to assist your calculation.
Thought process: Using the above strategy we…

1. Start at -5

2. Move 2 in the positive direction ↑

Answer: -3

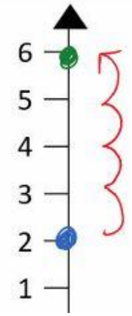


Question: Calculate $2 - {}^{-}4$ using a number line on the right to assist your calculation.
Thought process: Using the above strategy we…

1. Start at 2

2. Move 4 in the positive direction ↑

Answer: 6



Questions Part 3 of 3 – Adding and subtracting negative integers	*Helpful Information*
2. Complete the following additions and subtractions. a. $3 + {}^{-}2$ b. $1 - {}^{-}3$ c. ${}^{-}2 + {}^{-}2$ d. $4 + {}^{-}5$ e. ${}^{-}4 - {}^{-}4$ f. $0 + {}^{-}2$ g. $4 - {}^{-}1$ h. ${}^{-}2 + {}^{-}3$ i. $4 + {}^{-}9$ j. $3 + {}^{-}7$ k. ${}^{-}3 + {}^{-}3$ l. $0 - {}^{-}3$ m. ${}^{-}5 - {}^{-}4$ n. $2 - {}^{-}4$ o. ${}^{-}1 + {}^{-}3$ p. ${}^{-}4 + {}^{-}5$ q. $1 + {}^{-}7$ r. ${}^{-}1 - {}^{-}4$ s. $5 + {}^{-}3$ t. $0 - {}^{-}2$ *Answers* a. 1 b. 4 c. -4 d. -1 e. 0 f. -2 g. 5 h. -5 i. -5 j. -4 k. -6 l. 3 m. -1 n. 6 o. -4 p. -9 q. -6 r. 3 s. -2 t. 2	**Strategy – Adding and Subtracting Integers using a Number Line** The song below is helpful for remembering how to add and subtract integers using a number line. *♫Addition and subtraction are really big words so need to be handled with care* *Get your number line out, look at the first number, and put your finger there* *The only thing to know is which way to go, it's easy so don't you frown* *To add positive or take negative go up if not go down ♫*

3 powers and square roots

Questions Part 1 of 2 – Powers of Numbers	*Helpful Information*
3.1 Calculate the following a. 2^3 b. 11^2 c. 0^3 d. 2^2 e. 6^2 f. 7^2 g. 3^3 h. 5^2 i. 2^5 j. 4^2 k. 5^3 l. 10^2 m. 1^5 n. 3^2 o. 8^2 p. 1^2 *Answers* a. 8 b. 121 c. 0 d. 4 e. 36 f. 49 g. 27 h. 25 i. 32 j. 16 k. 125 l. 100 m. 1 n. 9 o. 64 p. 1	The **power** of a number tells you how many times to use the number in the multiplication. The exponent in 3^4 is 4 and is read as "3 to the power of 4" which means $3 \times 3 \times 3 \times 3$. We can see that the 3 has been used 4 times in the multiplication. Note that, powers of two are referred to as "squared" and powers of 3 are referred to as "cubed". For example 4^2 is read as "four squared" and 4^3 is read as "four cubed". *Example* **Question:** Calculate 2^3 **Thought process:** The power of 3 means that the 2 appears 3 times in the multiplication. This means we need to calculate $2 \times 2 \times 2$, and this is equal to 8 **Answer:** 8

Questions Part 2 of 2 – Square Roots of Numbers

3.2 Calculate the following

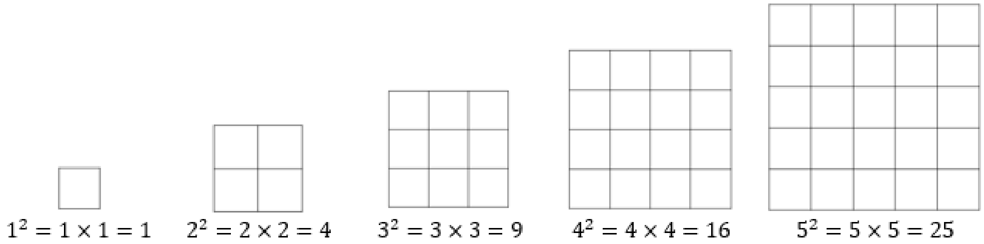
a.	$\sqrt{16}$	b.	$\sqrt{49}$	c.	$\sqrt{25}$	d.	$\sqrt{100}$
e.	$\sqrt{144}$	f.	$\sqrt{9}$	g.	$\sqrt{121}$	h.	$\sqrt{36}$
i.	$\sqrt{1}$	j.	$\sqrt{64}$	k.	$\sqrt{4}$	l.	$\sqrt{81}$

Answers

a. 4 b. 7 c. 5 d. 10 e. 12 f. 3 g. 11 h. 6 i. 1 j. 8 k. 2 l. 9

Helpful Information

As discussed in Part 1, powers of 2 are referred to as "squared". The diagram below shows why…



The **square root** of a number is the opposite of squaring a number and you need to work out what number, multiplied by itself, will make the number under the square root sign.

$\sqrt{49}$ is read as "the square root of 49" and means, what number multiplied by itself makes 49, so $\sqrt{49} = 7$

Example

Question: Calculate $\sqrt{16}$
Thought process: What number multiplied by itself makes 16? Since 4x4=16 the answer must be 4
Answer: 4

4 Order of Operations

Questions – Part 1 of 1

4.1 Calculate the following. Note that the expected detail in your working is demonstrated in the examples on the right.

a. 4×2^3	b. $(35 - 5) \div 10$	c. $6 + 7^2$	d. $20 \div 2 \times 5$
e. $\sqrt{24 - 15}$	f. $8 \times (5 + 3)$	g. $(5 + 3) \times 6$	h. $8 \times (1 + 7)$
i. $12 \div 3 + 9$	j. $4 \times 6 - 4$	k. $(10 - 2)^2$	l. $21 - 6 \times 2$
m. $6^2 \div 3$	n. $2 \times (3 + 5)$	o. $32 - 2 + 8$	p. $12 \div 3 \times 4$
q. $2 \times 6 + 7$	r. $2 \times 3 + 9$	s. $(3 + 9) \div 12$	t. $16 - 16 \div 12$

Answers

a. 32 b. 3 c. 55 d. 50 e. 3 f. 64 g. 48 h. 64 i. 13 j. 20 k. 64 l. 9 m. 12 n. 16 o. 38 p. 16 q. 19 r. 15 s. 1 t. 8

Helpful Information

A mathematical **operation** combines two values in some way. Examples of mathematical operations are addition, subtraction, multiplication and division.

The **order of operations** is the order which operations must be completed when more than one operation is present.

GEMA is a helpful acronym that reminds us the set order of operations. The order of operations is as follows:

G – Groupings (eg. brackets, operations together within a fraction)
E – Exponents (or powers)
M – Multiplication and Division (from left to right)
A – Addition and subtraction (from left to right)

Examples

Question: 4×2^3
Thought process:
Look for groupings, there are none. Look for exponents. There is a power so that must be done first.

Since only one operation is present we just complete the multiplication.
Answer: 32

4×2^3
$= 4 \times 8$
$= 32$

Question: $(35 - 5) \div 10$
Thought process:
Look for groupings first.
The subtraction is grouped in the bracket so must be done first.
Since only one operation is present, we just complete the division.
Answer: 3

$(35 - 5) \div 10$
$= 30 \div 10$
$= 3$

5 properties of numbers

Questions – Part 1 of 1

5.1 For each question, identify the words that describe the given number.

a. 45; Odd, square, prime, multiple of 3
b. 40; Even, square, prime, multiple of 3
c. 25; Even, square, prime, multiple of 2
d. 36; Even, square, prime, multiple of 4
e. 49; Odd, square, prime, multiple of 2
f. 17; Odd, square, prime, multiple of 5
g. 3; Even, square, prime, multiple of 3
h. 0; Odd, square, prime, multiple of 3
i. 60; Odd, square, prime, multiple of 3
j. 15; Even, square, prime, multiple of 5
k. 36; Even, square, prime, multiple of 5
l. 31; Odd, square, prime, multiple of 5
m. 7; Odd, square, prime, multiple of 4
n. 19; Odd, square, prime, multiple of 2
o. 13; Even, square, prime, multiple of 3
p. 2; Odd, square, prime, multiple of 5
q. 1; Odd, square, prime, multiple of 2
r. 12; Even, square, prime, multiple of 5
s. 18; Even, square, prime, multiple of 2
t. 37; Odd, square, prime, multiple of 4

Answers

a. odd, mult of 3 b. even c. square d. even, square, mult of 4 e. odd, square
f. odd, prime g. prime, mult of 3 h. square i. mult of 3 j. mult of 5 k. even, square
l. odd, prime m. odd, prime n. odd, prime o. prime p. prime q. odd, square
r. even s. even, mult of 2 t. odd, prime

Helpful Information

Whole numbers are classified as either even or odd.

An **even** number is created from doubling another whole number. The last digit of an even number will be a 0, 2, 4, 6 or 8. For example, 0, 14 and 20 are even numbers, though 3, 47 and 24.6 are not even numbers.

A whole number which is not even is called **odd**. Odd numbers end in a 1, 3, 5, 7 or 9. For example, 5, 9 and 17 are odd numbers, though 2, 8 and 3.9 are not.

A **square number** is a number that is the product of a whole number multiplied by itself. For example, 81 is a square number because 81=9x9, though 20 is not a square number as there is no whole number that can be multiplied by itself to make 20.

Example

Question: Identify the words that describe the number 45

Odd, square, prime, multiple of 3

Thought process:

- The number 45 ends in a 5 so is odd.
- 45 is not a square number as it is between 6x6=36 and 7x7=49.
- 45 is not a prime number as it can be written as the product of two numbers other than one and itself, for example 5x9.
- The sum of the digits in 45 is 9, since this is a multiple of 3 45 is also a multiple of 3.

Answer: Odd and multiple of 3

6 prime factorisation

Questions Part 1 of 3 – Knowing the prime numbers up to 20

6.1 For each of the numbers below state whether it is prime or not prime.

a. 1	b. 2	c. 3	d. 4	e. 5
f. 6	g. 7	h. 8	i. 9	j. 10
k. 11	l. 12	m. 13	n. 14	o. 15
p. 16	q. 17	r. 18	s. 19	t. 20

Answers

a. not prime b. prime c. prime d. not prime e. prime
f. not prime g. prime h. not prime i. not prime j. not prime
k. prime l. not prime m. prime n. not prime o. not prime
p. not prime q. prime r. not prime s. prime t. not prime

Helpful Information

A **prime number** is a number which has exactly two factors, one and itself.

The numbers 2, 3, 5, 7 and 11 are examples of prime numbers, while 4 is not prime because 2x2=4 and 15 is not prime either since 3x5=15.

A fun way to remember prime numbers is with the song below:

♫ I'm prime P. R. I. M. E
My only factors are 1 and me
Numbers that divide evenly
2, 3, 5, 7, 11 ♫

Examples

Question: Is 1 a prime number or not a prime?
Thought process: The only factor of 1 is 1. Since 1 does not have exactly two factors it is not prime.
Answer: Not a prime

Question: Is 2 a prime number or not a prime?
Thought process: The factors of 2 are 1 and 2. Since 2 has exactly two factors it is a prime number.
Answer: Prime

Questions Part 2 of 3 – Prime Factorisations of Numbers with Exactly Two Prime Factors

6.2 Write the following numbers as a product of two prime numbers. Note, it is best to write the prime numbers in increasing order.

a.	77	b.	82	c.	10	d.	51	e.	9
f.	15	g.	65	h.	6	i.	58	j.	35
k.	25	l.	77	m.	49	n.	55	o.	21
p.	4	q.	33	r.	38	s.	14	t.	121

Answers

a. 7x11 b. 2x41 c. 2x5 d. 3x17 e. 3x3 f. 3x5 g. 5x13 h. 2x3
i. 2x29 j. 5x7 k. 5x5 l. 7x11 m. 7x7 n. 5x11 o. 3x7 p. 2x2
q. 3x11 r. 2x19 s. 2x7 t. 11x11

A **product** is a formal word for a multiplication. For example, the product of 2 and 4 is 8.

A number under 150 which is not prime must have at least one of the primes 2, 3, 5, 7 or 11 as a factor. While there are bigger prime numbers that will divide it exactly, these will always be paired with one of these primes.

Examples

Question: Write the 77 as a product of two prime numbers
Thought process: 77=7x11
Answer: 7x11

Question: Write the 82 as a product of two prime numbers
Thought process: 82=2x41 since 2, 3, 5, 7 or 11 don't divide 41 exactly 41 must be prime
Answer: 2x41

Questions Part 3 of 3 – Prime Factorisations of Whole Numbers

6.3 Write the following numbers as a product of powers of prime numbers. Note, it is best to write the prime numbers in increasing order.

a.	54	b.	70	c.	64	d.	82	e.	10
f.	75	g.	78	h.	86	i.	18	j.	42
k.	66	l.	87	m.	99	n.	44	o.	84
p.	36	q.	46	r.	12	s.	38	t.	21

Answers

a. $2\text{x}3^3$ b. 2x5x7 c. 2^6 d. 2x41 e. 2x5 f. $3\text{x}5^2$ g. 2x3x13
h. 2x43 i. $2\text{x}3^2$ j. 2x3x7 k. 2x3x11 l. 3x29 m. $3^2\text{x}11$ n. $2^2\text{x}11$
o. $2^2\text{x}3\text{x}7$ p. $2^2\text{x}3^3$ q. 2x23 r. $2^2\text{x}3$ s. 2x19 t. 3x7

Helpful Information

If a number is not prime, by definition it has factors other than one and itself. Using this definition, one way to write a number as a product of prime numbers is to…

1. Begin by writing it as a product of any two numbers (except one and itself).
2. Then
   a. If both numbers are prime you are done (yay!),
   b. If one (or more) numbers isn't prime then write it as a product of any two numbers (except one and itself)
3. Repeat Step 2 until all numbers are prime.

Example

Question: Write 54 as a product of prime numbers. Note, it is best to write the prime numbers in increasing order.
Thought process: Using the strategy above…

$$54 = 9 \times 6$$
$$= 3 \times 3 \times 3 \times 2$$

Writing the numbers with powers we have $3^3\text{x}2$ in increasing order we get
Answer: $3^3\text{x}2$

7a highest common factor

7a Find the highest common factor (HCF) of each pair of numbers.

a. 36 and 48	b. 24 and 40	c. 55 and 72	d. 24 and 42
e. 24 and 60	f. 6 and 5	g. 8 and 24	h. 6 and 30
i. 12 and 72	j. 18 and 27	k. 25 and 18	l. 8 and 16
m. 9 and 90	n. 9 and 18	o. 27 and 36	p. 6 and 18
q. 16 and 24	r. 4 and 8	s. 4 and 12	t. 4 and 36

Answers

a. 12 b. 8 c. 1 d. 6 e. 12 f. 1 g. 8 h. 6 i. 12 j. 9 k. 1 l. 8 m. 9 n. 9 o. 9 p. 6

q. 8 r. 4 s. 4 t. 4

Helpful Information

The **highest common factor** of two (or more) numbers is the largest number which is a factor of both numbers

Strategy 1 - Using Lists to Find the HCF

1. Write out all the factors of the smallest number. Using factor pairs starting with 1.
2. Can you see the largest factor which is also a factor of the biggest number? If not…
3. Write out all the factors of the biggest number.
4. Identify the highest common factor.

Strategy 2 - Using a Procedure to Find the HCF

1. Write down the two numbers you are trying to find the HCF of beside each other and draw a vertical line on the left of them.
2. Identify, and write down, a common factor and divide both numbers by it.
3. Keep going until there are no more common factors.

Examples

Question: Find the highest common factor of 36 and 48.

Thought process: Using strategy 1 we have:

1	2	3	4	5	6
36	18	12	9	x	6

1	2	3	4	5	6	7
48	24	16	12	x	8	x

Answer: The HCF of 36 and 48 is 12

Question: Find the highest common factor of 36 and 48.

Thought process: Using strategy 2 we have:

	36	48
2	18	24
2	9	12
3	3	4

$\boxed{12}$

Answer: The HCF of 36 and 48 is 12

7b lowest common multiple

7b.1 Find the lowest common multiple (LCM) of each pair of numbers.

a. 8 and 12	b. 5 and 2	c. 10 and 15	d. 2 and 8
e. 6 and 9	f. 7 and 14	g. 4 and 7	h. 11 and 44
i. 7 and 9	j. 3 and 10	k. 3 and 15	l. 2 and 16
m. 7 and 35	n. 5 and 6	o. 5 and 20	p. 6 and 8
q. 4 and 10	r. 3 and 8	s. 9 and 5	t. 8 and 10

Answers

a. 24 b. 10 c. 30 d. 8 e. 18 f. 14 g. 28 h. 44 i. 63 j. 30 k. 15 l. 16 m. 35 n. 30 o. 20 p. 24 q. 20 r. 24 s. 45 t. 40

Helpful Information

> The **lowest common multiple** of two (or more) numbers is the smallest number which is a multiple of both numbers

Strategy 1 - Using Lists to Find the LCM
1. Write down the first 5 multiples of the biggest number.
2. Can you see the smallest multiple which is also a multiple of the smallest number? If not…
3. Write down the first 5 multiples of the smallest number.
4. If there is a common number in each list – great, if not keep writing down another 5 multiples of each number until there is a number common to both lists.

Strategy 2 - Using a Procedure to Find the LCM
1. Write down the two numbers you are trying to find the LCM of beside each other and draw a vertical line on the left of them.
2. Identify, and write down, a common factor and divide both numbers by it.
3. Keep going until there are no more common factors.
4. Multiply all common factors and the remaining numbers to calculate the LCM.

Examples

Question: Find the lowest common multiple of 8 and 12.
Thought process: Using strategy 1 we have:

12 24 36 48 60
8 16 24 32 40

Answer: The LCM of 12 and 8 is 24.

Question: Find the lowest common multiple of 8 and 12.
Thought process: Using strategy 2 we have:

$$\begin{array}{c|cc} & 8 & 12 \\ 2 & 4 & 6 \\ 2 & 2 & 3 \end{array} \qquad \boxed{24}$$

Answer: The LCM of 12 and 8 is 24.

8 converting between whole numbers, mixed and improper fractions

Questions Part 1 of 3 - Converting whole numbers to improper fractions

8.1 Fill in each box to make each equation involving a whole number and improper fraction true.

a. $3 = \frac{\square}{4}$	b. $9 = \frac{\square}{5}$	c. $8 = \frac{\square}{6}$	d. $11 = \frac{\square}{5}$
e. $9 = \frac{\square}{4}$	f. $2 = \frac{\square}{3}$	g. $4 = \frac{\square}{7}$	h. $5 = \frac{\square}{5}$
i. $9 = \frac{\square}{5}$	j. $12 = \frac{\square}{3}$	k. $2 = \frac{\square}{6}$	l. $4 = \frac{\square}{7}$
m. $11 = \frac{\square}{2}$	n. $1 = \frac{\square}{4}$	o. $9 = \frac{\square}{5}$	p. $6 = \frac{\square}{3}$
q. $10 = \frac{\square}{3}$	r. $11 = \frac{\square}{2}$	s. $4 = \frac{\square}{7}$	t. $6 = \frac{\square}{4}$

Answers

a. 12 b. 45 c. 48 d. 55 e. 36 f. 6 g. 28 h. 25 i. 45 j. 36 k. 12 l. 28 m. 22 n. 4 o. 45 p. 18 q. 30 r. 22 s. 28 t. 24

Helpful Information

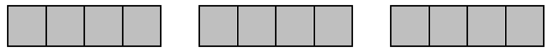
A **proper fraction** is a fraction where the numerator is less than the denominator.
An **improper fraction** is a fraction where the numerator is greater than or equal to the denominator. For example, $\frac{1}{3}$, $\frac{2}{3}$ and $\frac{3}{7}$ are proper fractions, while $\frac{4}{3}$, $\frac{8}{3}$ and $\frac{9}{5}$ are improper fractions.

Examples

Question: Fill in the box to make the equation involving the whole number and improper fraction true.

$$3 = \frac{\square}{4}$$

Thought process: We can represent 3 using 3 boxes. We can divide each whole into quarters as shown below.



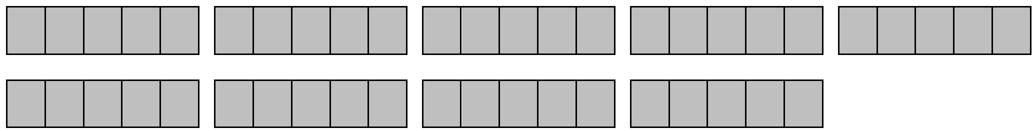
We can see that 3 the wholes are made up of $3 \times 4 = 12$ quarters.

Answer: $3 = \frac{\boxed{12}}{4}$

Question: Fill in the box to make the equation involving the whole number and improper fraction true.

$$9 = \frac{\square}{5}$$

Thought process: We can represent 9 using 9 boxes. We can divide each whole into fifths as shown below.



We can see that 9 the wholes are made up of $9 \times 5 = 45$ fifths.

Answer: $9 = \frac{\boxed{45}}{5}$

Questions Part 2 of 3 - Converting mixed numbers to improper fractions

8.2 Fill in each box to make each equation involving a mixed number and improper fraction true.

a. $2\frac{3}{4}=\frac{\square}{4}$	b. $2\frac{3}{5}=\frac{\square}{5}$	c. $5\frac{1}{4}=\frac{\square}{4}$	d. $5\frac{1}{2}=\frac{\square}{2}$
e. $2\frac{3}{4}=\frac{\square}{4}$	f. $6\frac{4}{7}=\frac{\square}{7}$	g. $4\frac{1}{7}=\frac{\square}{7}$	h. $4\frac{6}{7}=\frac{\square}{7}$
i. $1\frac{2}{5}=\frac{\square}{5}$	j. $2\frac{3}{5}=\frac{\square}{5}$	k. $2\frac{1}{5}=\frac{\square}{5}$	l. $2\frac{3}{4}=\frac{\square}{4}$
m. $2\frac{2}{5}=\frac{\square}{5}$	n. $2\frac{3}{4}=\frac{\square}{4}$	o. $1\frac{1}{3}=\frac{\square}{3}$	p. $5\frac{1}{2}=\frac{\square}{2}$
q. $6\frac{5}{7}=\frac{\square}{7}$	r. $4\frac{1}{2}=\frac{\square}{2}$	s. $4\frac{3}{4}=\frac{\square}{4}$	t. $1\frac{4}{5}=\frac{\square}{5}$

Answers

a. 37 b. 13 c. 21 d. 11 e. 11 f. 46 g. 29 h. 34 i. 7 j. 13 k. 11 l. 11 m. 12 n. 11 o. 4 p. 11 q. 47 r. 9 s. 19 t. 9

Helpful Information

A **mixed number** is made up of a whole number and a proper fraction.

For example, $2\frac{1}{3}$ and $-5\frac{11}{12}$ are mixed numbers, while $2\frac{5}{3}$ and $\frac{11}{3}$ are not.

Example

Question: Fill in the box to make the equation involving the mixed number and improper fraction true.

$$2\frac{3}{4}=\frac{\square}{4}$$

Thought process: The value of $2\frac{3}{4}$ is more than 2 wholes and less than 3 wholes so we will need 3 wholes to represent the value. We divide our wholes into quarters to work out how many quarters make up $2\frac{3}{4}$. Shading 2 wholes and 3 quarters gives...

By counting the number of shade quarters $(2\times4+3)$ that we have, we find we have 11 quarters and so $2\frac{3}{4}=\frac{11}{4}$

Answer: $2\frac{3}{4}=\frac{\boxed{11}}{4}$

Questions Part 3 of 3 - Converting improper fractions to mixed numbers

8.3 Fill in each box to make each equation involving a mixed number and improper fraction true.

a. $3\frac{\square}{2} = \frac{7}{2}$ b. $4\frac{\square}{3} = \frac{14}{3}$ c. $4\frac{\square}{5} = \frac{22}{5}$ d. $4\frac{\square}{4} = \frac{19}{4}$

e. $4\frac{\square}{4} = \frac{17}{4}$ f. $6\frac{\square}{2} = \frac{13}{2}$ g. $2\frac{\square}{5} = \frac{12}{5}$ h. $5\frac{\square}{5} = \frac{28}{5}$

i. $4\frac{\square}{4} = \frac{19}{4}$ j. $1\frac{\square}{5} = \frac{9}{5}$ k. $5\frac{\square}{3} = \frac{16}{3}$ l. $2\frac{\square}{3} = \frac{8}{3}$

m. $2\frac{\square}{5} = \frac{14}{5}$ n. $2\frac{\square}{7} = \frac{19}{7}$ o. $3\frac{\square}{4} = \frac{15}{4}$ p. $4\frac{\square}{2} = \frac{9}{2}$

q. $6\frac{\square}{2} = \frac{13}{2}$ r. $6\frac{\square}{4} = \frac{27}{4}$ s. $6\frac{\square}{7} = \frac{48}{7}$ t. $4\frac{\square}{5} = \frac{24}{5}$

Answers

a. 1 b. 2 c. 2 d. 3 e. 1 f. 1 g. 2 h. 3 i. 3 j. 4 k. 1 l. 2 m. 4 n. 5 o. 3 p. 1 q. 1 r. 3 s. 6 t. 4

Example

Question: Fill in the box to make the equation involving the mixed number and improper fraction true.

$$3\frac{\square}{2} = \frac{7}{2}$$

Thought process: Every whole is made up of 2 halves.

Since $7 \div 2 = 3$ remainder 1 we can represent $\frac{7}{2}$ as 3 wholes and 1 half (as shown below).

Answer: $3\frac{\boxed{1}}{2} = \frac{7}{2}$

Return to contents page

9 adding and subtracting fractions

9.1 Complete the following questions. The expected detail in your working is demonstrated in the example on the right.

a. $\frac{3}{5}-\frac{1}{10}$	b. $\frac{5}{24}+\frac{5}{8}$	c. $\frac{3}{4}+\frac{1}{24}$	d. $\frac{2}{3}-\frac{1}{30}$
e. $\frac{15}{20}+\frac{1}{10}$	f. $\frac{2}{7}+\frac{1}{14}$	g. $\frac{4}{24}+\frac{5}{8}$	h. $\frac{4}{5}+\frac{1}{25}$
i. $\frac{4}{8}+\frac{2}{40}$	j. $\frac{4}{5}-\frac{3}{10}$	k. $\frac{6}{7}-\frac{1}{14}$	l. $\frac{1}{15}+\frac{2}{5}$
m. $\frac{3}{4}-\frac{5}{8}$	n. $\frac{4}{8}+\frac{1}{16}$	o. $\frac{5}{6}+\frac{3}{18}$	p. $\frac{4}{5}-\frac{1}{10}$
q. $\frac{2}{21}+\frac{4}{7}$	r. $\frac{2}{3}-\frac{2}{15}$	s. $\frac{1}{3}-\frac{1}{15}$	t. $\frac{5}{9}-\frac{1}{27}$

Answers

a. $\frac{1}{2}$ b. $\frac{5}{6}$ c. $\frac{19}{24}$ d. $\frac{19}{30}$ e. $\frac{17}{20}$ f. $\frac{5}{14}$ g. $\frac{19}{24}$ h. $\frac{21}{25}$ i. $\frac{11}{20}$ j. $\frac{1}{2}$ k. $\frac{11}{14}$ l. $\frac{7}{15}$ m. $\frac{1}{8}$ n. $\frac{9}{16}$ o. 1 p. $\frac{7}{10}$ q. $\frac{2}{3}$ r. $\frac{8}{15}$ s. $\frac{4}{15}$ t. $\frac{14}{27}$

Helpful Information

Strategy for Adding and Subtracting Fractions with Different Denominators

1. Identify the lowest common multiple of the denominators
2. Re-write fraction sum using equivalent fractions whose denominators are the lowest common multiple
3. Add or subtract fractions
4. Simplify fraction if needed

If the answer is bigger than 1, you may choose if you write your answer as an improper fraction or as a mixed number.

Example

Question: Calculate $\frac{5}{6}+\frac{3}{4}$

Thought process: Using the above strategy we have…

$$\frac{5}{6} + \frac{3}{4}$$

$$\times 2 \qquad\qquad \times 3$$

$$= \frac{10}{12} + \frac{9}{2}$$

$$= \frac{19}{12} \qquad (\text{or } 1\tfrac{7}{12})$$

Answer: $\frac{19}{12}$ or $1\frac{7}{12}$

10 multiplying fractions

Questions Part 1 of 2 – Multiplying fractions

10.1 Complete the following multiplications. The expected detail in your working is demonstrated in the example on the right.

a. $\frac{3}{5}\times\frac{2}{12}$ b. $\frac{2}{4}\times\frac{7}{9}$ c. $\frac{4}{9}\times\frac{7}{8}$ d. $\frac{5}{9}\times\frac{1}{7}$

e. $\frac{5}{7}\times\frac{1}{5}$ f. $\frac{1}{2}\times\frac{10}{12}$ g. $\frac{1}{2}\times\frac{2}{4}$ h. $\frac{7}{9}\times\frac{4}{10}$

i. $\frac{3}{5}\times\frac{4}{10}$ j. $\frac{5}{6}\times\frac{3}{5}$ k. $\frac{3}{5}\times\frac{2}{3}$ l. $\frac{7}{9}\times\frac{7}{8}$

m. $\frac{5}{8}\times\frac{4}{7}$ n. $\frac{1}{3}\times\frac{9}{10}$ o. $\frac{4}{5}\times\frac{8}{9}$ p. $\frac{6}{7}\times\frac{3}{4}$

q. $\frac{4}{5}\times\frac{1}{4}$ r. $\frac{9}{10}\times\frac{4}{7}$ s. $\frac{6}{10}\times\frac{3}{5}$ t. $\frac{6}{10}\times\frac{3}{4}$

Answers

a. $\frac{1}{10}$ b. $\frac{7}{18}$ c. $\frac{7}{18}$ d. $\frac{5}{63}$ e. $\frac{1}{7}$ f. $\frac{5}{12}$ g. $\frac{1}{4}$ h. $\frac{14}{45}$ i. $\frac{6}{25}$ j. $\frac{1}{2}$ k. $\frac{2}{5}$ l. $\frac{49}{72}$ m. $\frac{5}{14}$ n. $\frac{3}{10}$ o. $\frac{32}{45}$ p. $\frac{9}{14}$

q. $\frac{1}{5}$ r. $\frac{18}{35}$ s. $\frac{9}{25}$ t. $\frac{9}{20}$

Helpful Information

Strategy for Multiplying Fractions

1. Simplify fractions first if possible
2. Multiply the numerators to form the new numerator
3. Multiply the denominators to form the new denominator
4. Simplify fraction if needed

Example

Question: Calculate $\frac{3}{5}\times\frac{2}{12}$

Thought process: Using the above strategy we have…

$$\frac{3}{5}\times\frac{2}{12} \quad \div 2$$
$$= \frac{3}{5}\times\frac{1}{6}$$
$$= \frac{3}{30} \quad \div 3$$
$$= \frac{1}{10}$$

Answer: $\frac{1}{10}$

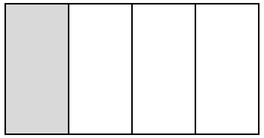
Return to contents page

🖶 *To be printed or completed using a stylus*

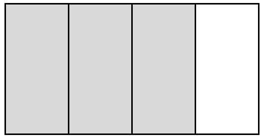
Questions Part 2 of 2 – Understanding why we can multiply fractions by multiplying the numerators and denominators

10.2 Use each picture below to represent and answer the multiplication questions. These pictures are designed to help you to see why we multiply the numerators and denominators when multiplying fractions.

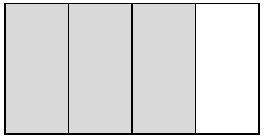
a. $\frac{1}{4} \times \frac{1}{5}$



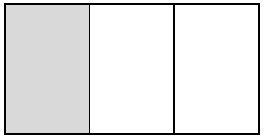
b. $\frac{3}{4} \times \frac{1}{5}$



c. $\frac{3}{4} \times \frac{3}{5}$



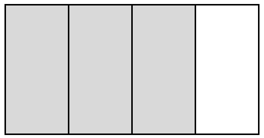
a. $\frac{1}{3} \times \frac{1}{5}$



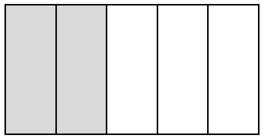
b. $\frac{2}{3} \times \frac{1}{5}$

c. $\frac{2}{3} \times \frac{4}{5}$

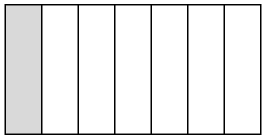
d. $\frac{3}{4} \times \frac{1}{5}$



e. $\frac{2}{5} \times \frac{3}{5}$



f. $\frac{1}{7} \times \frac{2}{5}$



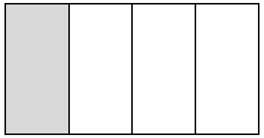
Answers

a. $\frac{1}{20}$ b. $\frac{3}{20}$ c. $\frac{9}{20}$ d. $\frac{1}{15}$ e. $\frac{2}{15}$ f. $\frac{8}{15}$ g. $\frac{3}{20}$ h. $\frac{6}{25}$ i. $\frac{2}{35}$

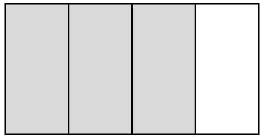
Example

Question: Use each picture below to represent and answer the multiplication questions.

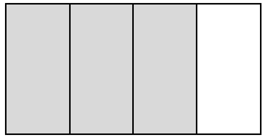
a. $\frac{1}{4} \times \frac{1}{5}$



b. $\frac{3}{4} \times \frac{1}{5}$

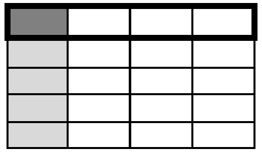


c. $\frac{3}{4} \times \frac{3}{5}$



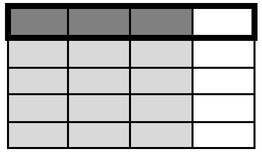
Thought process for Part a: $\frac{1}{4} \times \frac{1}{5}$ we need to take one-fifth of the quarter, as the diagram shows, this gives us one-twentieth (as the rectangle is now divided into 20 equal parts and we have one of these).

Answer for Part a: $\frac{1}{20}$



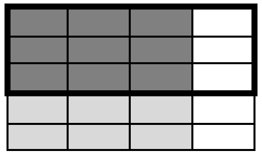
Thought process for Part b: $\frac{3}{4} \times \frac{1}{5}$ we need to take one-fifth of three-quarters, as the diagram shows, this gives us three-twentieths.

Answer for Part b: $\frac{3}{20}$



Thought process for Part c: $\frac{3}{4} \times \frac{3}{5}$ we need to take three-fifths of three-quarters, as the diagram shows, this gives us nine-twentieths.

Answer for Part c: $\frac{9}{20}$



11 dividing fractions

Questions Part 1 of 2 – Dividing fractions

11.1 Complete the following divisions. The expected detail in your working is demonstrated in the example on the right.

a. $\frac{3}{6} \div \frac{9}{8}$	b. $\frac{4}{5} \div \frac{5}{6}$	c. $\frac{3}{5} \div \frac{4}{7}$	d. $\frac{5}{10} \div \frac{9}{10}$
e. $\frac{1}{9} \div \frac{4}{5}$	f. $\frac{6}{10} \div \frac{8}{10}$	g. $\frac{3}{8} \div \frac{1}{10}$	h. $\frac{4}{6} \div \frac{1}{5}$
i. $\frac{9}{10} \div \frac{6}{9}$	j. $\frac{9}{10} \div \frac{2}{3}$	k. $\frac{4}{5} \div \frac{7}{8}$	l. $\frac{9}{10} \div \frac{4}{5}$
m. $\frac{5}{6} \div \frac{9}{10}$	n. $\frac{5}{8} \div \frac{2}{6}$	o. $\frac{2}{3} \div \frac{2}{6}$	p. $\frac{1}{3} \div \frac{6}{10}$
q. $\frac{3}{4} \div \frac{6}{7}$	r. $\frac{6}{7} \div \frac{1}{3}$	s. $\frac{1}{4} \div \frac{3}{4}$	t. $\frac{3}{10} \div \frac{4}{6}$

Answers

a. $\frac{4}{9}$ b. $\frac{24}{25}$ c. $\frac{21}{20}$ or $1\frac{1}{20}$ d. $\frac{5}{9}$ e. $\frac{5}{36}$ f. $\frac{3}{4}$ g. $\frac{15}{4}$ or $3\frac{3}{4}$ h. $\frac{10}{3}$ or $3\frac{1}{3}$ i. $\frac{27}{20}$ or $1\frac{7}{20}$

j. $\frac{27}{20}$ or $1\frac{7}{20}$ k. $\frac{32}{35}$ l. $\frac{9}{8}$ or $1\frac{1}{8}$ m. $\frac{25}{27}$ n. $\frac{15}{8}$ or $1\frac{7}{8}$ o. 2 p. $\frac{5}{9}$ q. $\frac{7}{8}$ r. $\frac{18}{7}$ or $2\frac{4}{7}$ s. $\frac{1}{3}$ t. $\frac{9}{20}$

Helpful Information

Strategy for Dividing Fractions

Re-write the division as a multiplication using KFC

> K – Keep the first fraction as is
> F – Flip the second fraction
> C – Change the division to a multiplication

Then multiply the fractions using knowledge from Skill 10

Example

Question: Calculate $\frac{3}{6} \div \frac{9}{8}$

Thought process: Using the above process we have…

$$\frac{3}{6} \div \frac{9}{8}$$

$$= \frac{3}{6} \times \frac{8}{9}$$

$\div 3$

$$= \frac{1}{2} \times \frac{8}{9}$$

$$= \frac{8}{18}$$

$\div 2$

$$= \frac{4}{9}$$

Answer: $\frac{4}{9}$

🖶 *To be printed or completed using a stylus* *Questions Part 2 of 2 – Understanding why we can divide fractions using the KFC method* **11.2** Explain why each of the following equations is true using part a. to help with part b. and part b. to help with part c. etc. a. $\frac{c}{d}\times\frac{d}{c}=1$ b. $1\div\frac{c}{d}=\frac{d}{c}$ c. $1\div\frac{c}{d}=1\times\frac{d}{c}$ d. $\frac{a}{b}\div\frac{c}{d}=\frac{a}{b}\times\frac{d}{c}$ *Answers* **a.** $\frac{c}{d}\times\frac{d}{c}=\frac{c\times d}{d\times c}$ and since $c\times d=d\times c$ the fraction must equal 1. In other words, this shows that $\frac{d}{c}$ is the reciprocal of $\frac{c}{d}$. b. Division is the opposite of multiplication so if we need $\frac{d}{c}$ groups of $\frac{c}{d}$ to make 1, then "1 how many groups of $\frac{c}{d}$" is $\frac{d}{c}$. c. $\frac{d}{c}=1\times\frac{d}{c}$ so if the equation in part b. is true then so is the equation in part c. d. Multiplying both sides of an equation by the same number creates another true equation. The equation in part c. is true, so multiplying both sides of the equation by $\frac{a}{b}$ produces another true equation.	*Helpful Information* The **reciprocal** of a number is the number you need to multiply it with to get an answer of 1. For example, the reciprocal of 3 is $\frac{1}{3}$ because $3\times\frac{1}{3}=1$ and the reciprocal of $\frac{3}{4}$ is $\frac{4}{3}$ because $\frac{3}{4}\times\frac{4}{3}=1$.

12 Fraction arithmetic with mixed numbers

Questions

12.1 Complete the following questions. Note that the expected detail in your working is demonstrated in the examples on the right.

a. $3\frac{1}{5}-1\frac{2}{5}$ b. $4\frac{1}{3}\div 5$ c. $1\frac{3}{5}-\frac{4}{5}$ d. $1\frac{2}{3}\div 3$

e. $2\frac{1}{5}\div\frac{1}{2}$ f. $1\frac{4}{5}\times 7$ g. $1\frac{1}{2}\times 4$ h. $3\frac{1}{5}-1\frac{2}{5}$

i. $1\frac{2}{3}\div\frac{1}{5}$ j. $3\frac{4}{5}\div 7$ k. $1\frac{1}{3}\div 4$ l. $2\frac{1}{3}\times\frac{2}{3}$

m. $3\frac{1}{6}\div 5$ n. $3\frac{4}{5}\div\frac{4}{5}$ o. $3\frac{1}{4}\div 7$ p. $2\frac{1}{4}\div 2$

q. $1\frac{3}{4}\div 3$ r. $1\frac{1}{4}-\frac{2}{4}$ s. $2\frac{2}{3}\div 4$ t. $3\frac{2}{5}\div 5$

Answers

a. $\frac{9}{5}$ b. $\frac{13}{15}$ c. $\frac{4}{5}$ d. $\frac{5}{9}$ e. $\frac{22}{5}$ or $4\frac{2}{5}$ f. $\frac{63}{5}$ or $12\frac{3}{5}$ g. 6 h. $\frac{9}{5}$ or $1\frac{4}{5}$ i. $\frac{25}{3}$ or $8\frac{1}{3}$

j. $\frac{19}{35}$ k. $\frac{1}{3}$ l. $\frac{14}{9}$ or $1\frac{5}{9}$ m. $\frac{19}{30}$ n. $\frac{19}{4}$ or $4\frac{3}{4}$ o. $\frac{13}{28}$ p. $\frac{9}{8}$ or $1\frac{1}{8}$ q. $\frac{7}{12}$ r. $\frac{3}{4}$ s. $\frac{2}{3}$ t. $\frac{17}{25}$

Helpful Information

If you can't see a simpler way to answer the question…

Strategy for Completing Mixed Number Arithmetic

1. Convert all mixed and whole numbers to improper fractions
2. Use the standard approaches used in skills 9 to 11.

Examples

Question: Calculate $3\frac{1}{5}-1\frac{2}{5}$

Thought process: Using the above strategy we have…

$$3\frac{1}{5}-1\frac{2}{5}$$
$$=\frac{16}{5}-\frac{7}{5}$$
$$=\frac{9}{5} \quad \left(\text{or } 1\frac{4}{5}\right)$$

Answer: $\frac{9}{5}$

Question: Calculate $4\frac{1}{3}\div 5$

Thought process: Using the above strategy we have…

$$4\frac{1}{3}\div 5$$
$$=\frac{13}{3}\div\frac{5}{1}$$
$$=\frac{13}{3}\times\frac{1}{5}$$
$$=\frac{13}{15}$$

Answer: $\frac{13}{15}$

13 place value and rounding of decimals

Questions Part 1 of 2 – Place Value of Decimal Numbers

13.1 What is the place value of the underlined number in each of the following.

a. $3.4\underline{5}1$	b. $1.20\underline{3}$	c. $10.\underline{2}$	d. $12.\underline{3}6$	e. $9.81\underline{2}$
f. $51.076\underline{2}$	g. $3.\underline{0}782$	h. $0.1\underline{0}2$	i. $169.\underline{3}$	j. $5.271\underline{6}$
k. $0.\underline{2}$	l. $0.0\underline{2}$	m. $0.\underline{1}2$	n. $15.\underline{1}$	o. $0.000\underline{2}$

Answers

a. 5 hundredths b. 3 thousandths c. 2 tenths d. 3 tenths e. 2 thousandths
f. 2 ten-thousandths g. 0 tenths h. 0 hundredths i. 3 tenths j. 6 ten-thousandths
k. 2 tenths l. 2 hundredths m. 1 tenth n. 1 tenth o. 2 ten-thousandths

Helpful Information

A **decimal number** is a number that contains values less than one whole. The first four place value names in a decimal number are tenths, hundredths, thousandths and ten-thousandths.

The **decimal point** is the name given to the symbol that separates the whole and decimal parts of a number.

This table shows the **place value** names for the digits in the number 2.5341

Ones	Tenths	Hundredths	Thousandths	Ten-thousandths
2	5	3	4	1

Example

Question: What is the place value of the underlined digit $3.4\underline{5}1$

Thought process: The 5 is the second number after the decimal point so has the value of 5 hundredths.

Answer: 5 hundredths

Questions Part 2 of 2 – Rounding Decimal Numbers in Simple Cases

13.2 Round each number to the number of decimal places indicated**.**

a.	5.994 (1 dp.)	b.	3.198 (2 dp.)	c.	3.1579 (3 dp.)	d.	0.197 (2 dp.)
e.	3.68751 (2 dp.)	f.	0.397 (2 dp.)	g.	36.81 (1 dp.)	h.	1.027 (1 dp.)
i.	2.9420 (3 dp.)	j.	21.9061 (2 dp.)	k.	1.968 (1 dp.)	l.	0.3501 (2 dp.)
m.	0.97381 (2 dp.)	n.	0.367 (2 dp.)	o.	31.864 (1 dp.)	p.	4.6749 (3 dp.)
q.	1.9460 (3 dp.)	r.	33.192 (2 dp.)	s.	1.868 (1 dp.)	t.	42.387 (2 dp.)

Answers

a. 6.0 b. 3.20 c. 3.158 d. 0.20 e. 3.69 f. 0.40 g. 36.8 h. 1.0 i. 2.942 j. 21.91 k. 2.0
l. 0.35 m. 0.97 n. 0.37 o. 31.9 p. 4.675 q. 1.946 r. 33.19 s. 1.9 t. 42.39

Helpful Information

Rounding is the process of approximating a number by removing smaller place value parts.

Rounding Rules

If next digit is smaller than 5 → round down
If next digit is 5 or bigger → round up

Process for rounding a decimal

1. Underline the number to the specified number of decimal places
2. Put a box around the next digit
3. If the number in the box is 5 or bigger increase the underlined "number" by 1
4. Remove digits that are not underlined

Example

Question: Round 5.994 to 1 decimal place (1 dp.)

Thought process: Completing steps 1 and 2 above gives:

$$\underline{5.9}\,\boxed{9}\,4$$

Since the number in the box is 5 or bigger then we increase "number" 59 to 60. Removing digits that aren't underlined we get 6.0

Answer: 6.0

14 comparing decimals

Questions Part 1 of 2 – Comparing whole numbers using < , = and >

14.1 Put a <, = or > between the numbers and, if possible, underline the biggest number.

a.	429 and 480	b.	15 and 12	c.	1000 and 32	d.	3 and 6
e.	12 and 7	f.	200 and 132	g.	46 and 46	h.	20 and 18
i.	5 and 47	j.	92 and 192	k.	8 and 8	l.	17 and 12

Answers

a. 429 < $\underline{480}$ b. $\underline{15}$ > 12 c. $\underline{1000}$ > 32 d. 3 < $\underline{6}$ e. $\underline{12}$ > 7 f. $\underline{200}$ > 132 g. 46 = 46 h. $\underline{20}$ > 18 i. 5 < $\underline{47}$ j. 92 < $\underline{192}$ k. 8 = 8 l. $\underline{17}$ > 12

Helpful Information

Below are three symbols that compare two values

	< is the less than symbol, for example 2 < 7
	= is the equals sign, for example 4 = 4
	> is the greater than symbol, for example 7>2

Strategy for Comparing Numbers

1. Write the numbers one below the other so that the digits with the same place value are aligned.
2. Start comparing digits in the same place value position starting on the far left.
   a. If the digits are the same continue to the next digit
   b. If one digit is bigger than the other circle it*
3. The number with the circled digit is the bigger number.

*If there is no occasion where one digit is bigger than the other, the numbers are of equal value.

Example

Question: Put a <, = or > between the n**umbers** and, if possible, underline the biggest n**umber**.

$$429 \qquad 480$$

Thought process: Following the strategy above…

4 2 9
4 8 0

Answer:

$$429 < \underline{480}$$

Questions Part 2 of 2

14.2 Put a <, = or > between the decimals and, if possible, underline the biggest decimal.

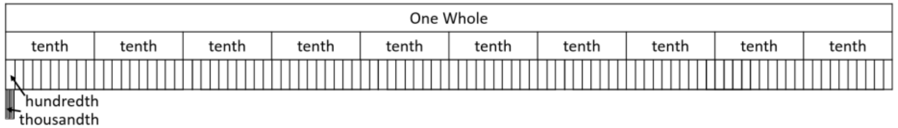
a. 1.06 1.053	b. 8.131 8.183202	c. 0.063 0.06	d. 3.621 6.06729
e. 0.7 0.96	f. 1.35 1.35612	g. 1.324 1.2431	h. 5.9 5.15
i. 0.1 0.01	j. 3.1206 3.12	k. 0.02 0.20	l. 0.5 0.50
m. 4.6 4.06	n. 3.21 3.210	o. 0.39 0.197	p. 1.75 1.08
q. 7.601 7.016	r. 0.005 0.500	s. 0.2 0.103	t. 0.90 0.9000

Answers

a. <u>1.06</u> > 1.053 b. 8.131 < <u>8.183202</u> c. <u>0.063</u> > 0.06 d. 3.621 < <u>6.06729</u> e. 0.7 < <u>0.96</u>
f. 1.35 < <u>1.35612</u> g. <u>1.324</u> > 1.2431 h. <u>5.9</u> > 5.15 i. <u>0.1</u> > 0.01 j. <u>3.1206</u> > 3.12 k. 0.02 < <u>0.20</u>
l. 0.5 = 0.50 m. <u>4.6</u> > 4.06 n. 3.21 = 3.210 o. <u>0.39</u> > 0.197 p. <u>1.75</u> > 1.08 q. <u>7.601</u> > 7.016
r. 0.005 < <u>0.500</u> s. <u>0.2</u> > 0.103 t. 0.90 = 0.9000

Helpful Information

The below image shows how the size of decimal parts compare.



We can see that tenths are bigger than hundredths, and hundredths are bigger than thousandths.

Strategy for Comparing Decimals

1. Write the numbers one below the other so that the digits with the same place value are aligned.
2. Start comparing digits in the same place value position starting on the far left.
   a. If the digits are the same continue to the next digit
   b. If one digit is bigger than the other circle it*
3. The number with the circled digit is the bigger number.

*If there is no occasion where one digit is bigger than the other, the numbers are of equal value.

Example

Question: Put a <, = or > between the decimals and, if possible, underline the biggest decimal.

1.06 1.053

Thought process: Following the strategy above…

1.06
1.053

Answer: <u>1.06</u> > 1.053

Return to contents page

15 multiplying and dividing by 10, 100 and 0.1

Questions Part 1 of 3 – Multiplying and dividing whole numbers by 10

15a Calculate the following.

a. 3400×10	b. $800 \div 10$	c. $5430 \div 10$	d. 70×10
e. 35400×10	f. $1040 \div 10$	g. 3500×10	h. $80 \div 10$
i. $7100 \div 10$	j. $100 \div 10$	k. 1900×10	l. 8×10
m. $60 \div 10$	n. 18000×10	o. 5200×10	p. $6310 \div 10$
q. 470×10	r. 950×10	s. $2600 \div 10$	t. $310 \div 10$

Answers

a. 34 000 b. 80 c. 543 d. 700 e. 354 000 f. 104 g. 35 000 h. 8 i. 710 j. 10 k. 19 000 l. 80 m. 6 n. 180 000 o. 52 000 p. 631 q. 4700 r. 9500 s. 260 t. 31

Helpful Information

Multiplying by 10 moves digits up one place value. This can be achieved by moving the decimal point one position to the right

Dividing by 10 moves digits down one place value. This can be achieved by moving the decimal point one position to the left

- Whole numbers don't start with zeros
- Decimals don't end with zeros
- Fill in empty place value positions with zeros, which includes the one place which is never empty

Examples

Question: Calculate 3400×10

Thought process: To multiply a number by 10 we move the decimal point one position to the right. So 3400. becomes 3400 . We include an extra zero to fill the empty place value position. So 3400 . becomes 34000

Answer: 34000

Question: Calculate $800 \div 10$

Thought process: To divide a number by 10 we move the decimal point one position to the left. So 800. becomes 80.0. We remove the zero at the end of the number. So 80.0 becomes 80

Answer: 80

Questions Part 2 of 3 – Multiplying and dividing decimal numbers by 10	*Helpful Information*
15b Calculate the following. a. 0.35×10 b. $0.103 \div 10$ c. 0.6×10 d. $14.12 \div 10$ e. 0.157×10 f. $1.7 \div 10$ g. 3.2×10 h. $0.06 \div 10$ i. $0.12 \div 10$ j. $12.9 \div 10$ k. 0.42×10 l. 0.3×10 m. $1.96 \div 10$ n. 1.2×10 o. 13.42×10 p. $1.42 \div 10$ q. 0.003×10 r. 0.02×10 s. $0.042 \div 10$ t. $1.2 \div 10$ *Answers* a. 3.5 b. 0.0103 c. 6 d. 1.412 e. 1.57 f. 0.17 g. 32 h. 0.006 i. 0.012 j. 1.29 k. 4.2 l. 3 m. 0.196 n. 12 o. 134.2 p. 0.142 q. 0.03 r. 0.2 s. 0.0042 t. 0.12	Multiplying by 10 moves digits up one place value. This can be achieved by moving the decimal point one position to the right Dividing by 10 moves digits down one place value. This can be achieved by moving the decimal point one position to the left • Whole numbers don't start with zeros • Decimals don't end with zeros • Fill in empty place value positions with zeros, which includes the one place which is never empty *Examples* **Question:** Calculate 0.35×10 **Thought process:** To multiply a number by 10 we move the decimal point one position to the right. So 0.35 becomes 3.5 **Answer:** 3.5 **Question:** Calculate $0.103 \div 10$ **Thought process:** To divide a number by 10 we move the decimal point one position to the left. So 0.103 becomes .0103. We include an extra zero at the start of the number as the ones place is best not empty. So .0103 becomes 0.0103 **Answer:** 0.0130

Questions Part 3 of 3 – Multiplying and dividing by 100

Calculate the following.

a. 0.0301×100	b. $1.03 \div 100$	c. 6.01×100	d. 6.2×100
e. $0.035 \div 100$	f. $140 \div 100$	g. 3.1×100	h. $310 \div 100$
i. $2 \div 100$	j. $15.6 \div 100$	k. 0.21×100	l. 0.9×100
m. $67 \div 100$	n. 0.03×100	o. 0.213×100	p. $8.61 \div 100$
q. 0.5×100	r. 1.903×100	s. $0.5 \div 100$	t. $153 \div 100$

Answers

a. 3.01 b. 3.1 c. 0.0103 d. 620 e. 0.00035 f. 1.4 g. 310 h. 601 i. 0.02 j. 0.156
k. 21 l. 90 m. 0.67 n. 3 o. 21.3 p. 0.0861 q. 50 r. 190.3 s. 0.005 t. 1.53

Helpful Information

Multiplying by 100 moves digits up two place value positions. This can be achieved by moving the decimal point two positions to the right

Dividing by 100 moves digits down two place value positions. This can be achieved by moving the decimal point two positions to the left

- Whole numbers don't start with zeros
- Decimals don't end with zeros
- Fill in empty place value positions with zeros, which includes the one place which is never empty

Examples

Question: Calculate 0.0301×100

Thought process: To multiply a number by 100 we move the decimal point two positions to the right. So 0.0301 becomes 003.01. We remove the zeros at the start of the whole number so 003.01 becomes 3.01

Answer: 3.01

Question: Calculate $1.03 \div 100$

Thought process: To divide a number by 100 we move the decimal point two positions to the right. So 1.03 becomes .0103. We include an extra zero at the start of the number as the ones place is best not empty. So .0103 becomes 0.0103

Answer: 0.0130

16 Converting between fractions, percentages and decimals

Questions Part 1 of 4 – Converting fractions to percentages and decimals

16.1 Convert the following fractions to percentages and decimals.

a. $\frac{13}{25}$ b. $\frac{3}{10}$ c. $\frac{17}{20}$ d. $\frac{24}{25}$

e. $\frac{19}{50}$ f. $\frac{14}{25}$ g. $\frac{7}{10}$ h. $\frac{3}{20}$

i. $\frac{47}{50}$ j. $\frac{3}{4}$ k. $\frac{4}{5}$ l. $\frac{9}{25}$

Answers

a. 52%, 0.52 b. 30%, 0.3 c. 85%, 0.85 d. 96%, 0.96 e. 38%, 0.38 f. 56%, 0.56
g. 70%, 0.7 h. 15%, 0.15 i. 94%, 0.94 j. 75%, 0.75 k. 80%, 0.8 l. 36%, 0.36

Helpful Information

Percentage means "out of 100" and is represented by the symbol %.
For example, 13% means 13 out of 100.

Strategy for Converting a Fraction to a Percentage and a Decimal

1. If possible, rewrite the fraction as an equivalent fraction with a denominator of 100
2. Read off the percentage
3. Think of the fraction as a division to convert to a decimal

Example

Question: Convert $\frac{13}{25}$ to a percentage and a decimal.

Thought process: Using the strategy above… we first rewrite the fraction as an equivalent fraction with a denominator of 100

$$\frac{13}{25} \overset{\times 4}{=} \frac{52}{100} \quad (\times 4)$$

We then read off the percentage. Since $\frac{52}{100}$ is 52% by definition of a percentage.
We convert the fraction to a decimal as follows.

$$\frac{52}{100} = 52 \div 100 = 0.52$$

Answer: 52%, 0.52

Questions Part 2 of 4 – Converting decimals to percentages and fractions

16.2 Convert the following decimals to percentages and fractions. Give fractions in simplified form.

a. 0.4	b. 0.64	c. 0.04	d. 0.8
e. 0.48	f. 0.14	g. 0.08	h. 0.3
i. 0.35	j. 0.72	k. 0.85	l. 0.6

Answers

a. $40\%, \frac{2}{5}$ b. 64% $\frac{16}{25}$ c. 4% $\frac{1}{25}$ d. 80% $\frac{4}{5}$ e. 48% $\frac{12}{25}$ f. 14% $\frac{7}{50}$ g. 8% $\frac{2}{25}$ h. 30% $\frac{3}{10}$
i. 35% $\frac{7}{20}$ j. 72% $\frac{18}{25}$ k. 85% $\frac{17}{20}$ l. 60% $\frac{3}{5}$

Helpful Information

Strategy for Converting a Decimal to a Percentage and a Fraction

1. Convert the decimal to a fraction by reading the decimal as something hundredths
2. Read off the percentage
3. Simplify the fraction

Example

Question: Convert 0.4 to a percentage and a fraction.

Thought process: Using the strategy above… we first read the decimal as 40 hundredths

$$0.4 = 0.40 = \frac{40}{100}$$

We then read off the percentage. Since $\frac{40}{100}$ is 40% by definition of a percentage.

We simplify the fraction as follows.

$$\frac{40}{100} = \frac{4}{10} = \frac{2}{5}$$

Answer: $40\%, \frac{2}{5}$

Questions Part 3 of 4 – Converting percentages to fractions and decimals

16.3 Convert the following percentages to fractions and decimals. Give fractions in simplified from.

a. 74%	b. 84%	c. 94%	d. 70%
e. 6%	f. 2%	g. 85%	h. 54%
i. 42%	j. 25%	k. 56%	l. 8%

Answers

a. $\frac{37}{50}$, 0.74 b. $\frac{21}{25}$, 0.84 c. $\frac{47}{50}$, 94% d. $\frac{7}{10}$, 0.7 e. $\frac{3}{50}$, 0.06 f. $\frac{1}{50}$, 0.02 g. $\frac{17}{20}$, 0.85 h. $\frac{27}{50}$, 0.54 i. $\frac{21}{50}$, 0.42 j. $\frac{1}{4}$, 0.25 k. $\frac{14}{25}$, 0.56 l. $\frac{2}{25}$, 8%

Helpful Information

Strategy for Converting a Percentage to a Fraction and a Decimal

1. Convert the percentage to a fraction by reading per-cent as per-hundred
2. Simplify the fraction
3. Interpret the fraction found in step 1 as a division to convert to a decimal.

Example

Question: Convert 74% to a fraction and a decimal.

Thought process: Using the strategy above… we first rewrite the percentage as a fraction and simplify.

$$74\% = \frac{74}{100} = \frac{37}{50}$$

We then use the fraction with a denominator of 100 and rewrite the fraction as a division to convert to a decimal.

$$\frac{74}{100} = 74 \div 100 = 0.74$$

Answer: $\frac{37}{50}$, 0.74

Questions Part 4 of 4 – Converting between fractions, decimals and percentages

16.4 Complete each table. Make sure your fraction is given in simplified form in each case.

a.

P	F	D
		0.78

b.

P	F	D
	$\frac{1}{25}$	

c.

P	F	D
40%		

d.

P	F	D
		0.3

e.

P	F	D
	$\frac{7}{20}$	

f.

P	F	D
		0.46

g.

P	F	D
		0.2

h.

P	F	D
		0.58

i.

P	F	D
18%		

j.

P	F	D
	$\frac{2}{25}$	

k.

P	F	D
	$\frac{19}{50}$	

l.

P	F	D
		0.24

m.

P	F	D
15%		

n.

P	F	D
94%		

o.

P	F	D
	$\frac{9}{10}$	

p.

P	F	D
		0.03

q.

P	F	D
80%		

r.

P	F	D
	$\frac{7}{25}$	

s.

P	F	D
54%		

t.

P	F	D
		0.6

Answers

a. 78%, $\frac{39}{50}$ b. 4%, 0.04 c. $\frac{2}{5}$, 0.4 d. 30%, $\frac{3}{10}$ e. 35%, 0.35 f. 46%, $\frac{23}{50}$ g. 20%, $\frac{1}{5}$ h. 58%, $\frac{29}{50}$ i. $\frac{9}{50}$, 0.18 j. 8%, 0.08 k. 38%, 0.38 l. 24%, $\frac{6}{25}$ m. $\frac{3}{20}$, 0.15 n. $\frac{47}{50}$, 0.94 o. 90%, 0.9 p. 3%, $\frac{3}{100}$ q. $\frac{4}{5}$, 0.8 r. 28%, 0.28 s. $\frac{27}{50}$, 0.54 t. 60%, $\frac{3}{5}$

17 adding and subtracting decimals

17.1 Complete the following questions. The expected detail in your working is demonstrated in the example on the right.

a. $5.29 - 3.6$	b. $7.72 + 5.75$	c. $13.4 - 2.57$	d. $5.58 - 3.61$
e. $4.7 + 13.32$	f. $5.58 - 3.6$	g. $3.38 - 2.7$	h. $3.6 + 4.99$
i. $8.4 - 3.96$	j. $1.99 + 4.6$	k. $1.7 + 3.58$	l. $2.47 - 1.6$
m. $4.2 - 0.74$	n. $1.59 + 3.7$	o. $2.34 - 1.76$	p. $0.59 + 3.6$
q. $3.6 + 0.59$	r. $5.56 + 2.8$	s. $3.55 - 1.9$	t. $3.97 + 2.9$

Answers

a. 1.69 b. 13.47 c. 10.83 d. 1.97 e. 18.02 f. 1.98 g. 0.68 h. 8.59 i. 4.44 j. 6.59
k. 5.28 l. 0.87 m. 3.46 n. 5.29
o. 0.58 p. 4.19 q. 4.19 r. 8.36 s. 1.65 t. 6.87

Helpful Information

When setting up the addition or subtraction algorithm remember to write the numbers so that the digits with the same place value are aligned.

It can also be helpful to make the numbers have the same number of decimal places by adding zeros to the end of the number with fewer digits.

Example

Question: Calculate $5.29 - 3.6$

Thought process: Using the suggestions above we have…

$$\begin{array}{r} {}^{4}\cancel{5}.{}^{1}2\,9 \\ -\,3.\,6\,0 \\ \hline 1.\,6\,9 \end{array}$$

Answer: 1.69

18 multiplying decimals

Questions Part 1 of 2 – Multiplying decimals

18.1 Complete the following questions. Note that the expected detail in your working is demonstrated in the example on the right.

a. 7.35×0.4	b. 4.7×5	c. 2.41×0.5	d. 2.6×2
e. 0.87×0.3	f. 0.234×0.04	g. 0.78×0.4	h. 4.85×0.03
i. 2.79×3	j. 2.87×0.3	k. 2.36×0.4	l. 0.9×5
m. 35.4×6	n. 4.89×3	o. 4.89×0.3	p. 0.86×0.04
q. 0.031×0.02	r. 3.72×2	s. 0.08×0.05	t. 4.77×0.6

Answers

a. 2.94 b. 23.5 c. 1.205 d. 5.2 e. 0.261 f. 0.00936 g. 0.312 h. 0.1455 i. 8.37 j. 0.861 k. 0.944 l. 4.5 m. 212.4 n. 14.67 o. 1.467 p. 0.0344 q. 0.00062 r. 7.44 s. 0.004 t. 2.862

Helpful Information

Strategy to Multiply Decimals

1. Multiply numbers as if the decimal point(s) aren't there.
2. Re-write your whole number answer with as many decimal places as there were in total between the numbers in the original question
3. If possible, check if answer seems reasonable

Example

Question: Calculate 7.35×0.4

Thought process: Using the above strategy we have…

$$\begin{array}{r} {}^{1}7\,{}^{2}3\,5 \\ \times \quad 4 \\ \hline 2\,9\,4\,0 \end{array}$$

$$7 \cdot \underline{35} \times 0 \cdot \underline{4} = 2.\underline{940}$$

$$7 \cdot 35 \times 0 \cdot 4 \approx 7 \times 0 \cdot 5$$
$$= 3 \cdot 5$$

So answer is reasonable

Answer: 2.94

Return to contents page

Questions Part 2 of 2 – Understanding why "the number of decimal places in the question gives the number of decimal places in the answer" when multiplying decimals

18.2 In each case the decimals have been converted to fractions. Calculate the product of the fractions, then divide by the denominator to give your answer as a decimal.

a. 3.23×0.4

$\frac{323}{100} \times \frac{4}{10}$

b. 0.65×7

$\frac{65}{100} \times \frac{7}{1}$

c. 4.2×0.7

$\frac{42}{10} \times \frac{7}{10}$

d. 5.34×0.2

$\frac{534}{100} \times \frac{2}{10}$

e. Why do the number of decimal places in the answer come from the number of decimal places in the question?

Answers

a. 1.292 b. 4.55 c. 2.94 d. 1.068 e. Say there are m decimal places in the first decimal and n decimal places in the second. The denominator of the fraction representation of the first fraction will be 10^m, and similarly 10^n for the second. When the fractions are multiplied the denominator will be $10^m \times 10^n$. When the numerator is divided by this value the result is $m + n$ decimal places, which is the total number of decimal places in the question.

Each decimal multiplication question can be calculated by first converting the decimals to fractions then multiplying the fractions.

Example

Question: Calculate the product of the fractions that have been used to represent the decimal multiplication, then divide by the denominator to give your answer as a decimal.

$$3.23 \times 0.4$$

$$\frac{323}{100} \times \frac{4}{10}$$

Thought process: Multiplying the fractions, then following the instructions gives…

$$\frac{323}{100} \times \frac{4}{10} = \frac{1292}{1000}$$

$$= 1.292$$

$$\begin{array}{r} 323 \\ \times \quad 4 \\ \hline 1292 \end{array}$$

Answer: 1.292

19 dividing decimals

Questions Part 1 of 3 – Dividing decimals by whole numbers

19.1 Complete the following questions. Note that the expected detail in your working is demonstrated in the example on the right.

a. 5.72 ÷ 5	b. 2.7 ÷ 3	c. 7.44 ÷ 4	d. 23.82 ÷ 6
e. 13.85 ÷ 5	f. 7.6 ÷ 4	g. 11.12 ÷ 2	h. 18.5 ÷ 5
i. 17.4 ÷ 3	j. 3.3 ÷ 6	k. 14.36 ÷ 4	l. 13.8 ÷ 3
m. 9.5 ÷ 5	n. 1.94 ÷ 2	o. 13.74 ÷ 3	p. 3.48 ÷ 4

Answers

a. 1.144 b. 0.9 c. 1.86 d. 3.97 e. 2.77 f. 1.9 g. 5.56 h. 3.7 i. 5.8 j. 0.55 k. 3.59 l. 4.6 m. 1.9 n. 0.97 o. 4.58 p. 0.87

Helpful Information

Strategy to Divide a Decimal by a Whole Number

1. Set up the standard division algorithm
2. Line up the decimal place in the answer with the decimal place in the question
3. Carry out the division (if needed, add extra zeros until there are no more remainders, or a clear pattern emerges)

Example

Question: 5.72 ÷ 5

Thought process: Using the strategy above we have…

$$\begin{array}{r} 1.144 \\ 5\overline{)5.7^{2}2^{2}0} \end{array}$$

Answer: 1.144

Questions Part 2 of 3 – Dividing decimals by decimals

19.2 Complete the following questions. Note that the expected detail in your working is demonstrated in the example on the right.

a. 0.014 ÷ 0.04	b. 0.156 ÷ 0.06	c. 0.96 ÷ 0.6	d. 0.012 ÷ 0.02
e. 1.104 ÷ 0.4	f. 2.76 ÷ 0.6	g. 0.118 ÷ 0.2	h. 0.237 ÷ 0.06
i. 0.175 ÷ 0.05	j. 0.18 ÷ 0.3	k. 0.014 ÷ 0.02	l. 0.576 ÷ 0.6
m. 0.0861 ÷ 0.03	n. 0.097 ÷ 0.02	o. 0.076 ÷ 0.04	p. 1.08 ÷ 0.6

Answers

a. 0.35 b. 2.6 c. 1.6 d. 0.6 e. 2.76 f. 4.6 g. 0.59 h. 3.95 i. 3.5 j. 0.6 k. 0.7 l. 0.96 m. 2.87 n. 4.85 o. 1.9 p. 1.8

Helpful Information

Strategy to Divide a Decimal by a Decimal

1. Write the division as a fraction
2. Multiply numerator and denominator by 10 until the denominator is a whole number
3. Carry out the division using the division algorithm

Example

Question: 0.014 ÷ 0.04

Thought process: Using the strategy above we have…

$$0.014 \div 0.04 = \frac{0.014}{0.04} = \frac{0.14}{0.4} = \frac{1.4}{4}$$

$$\begin{array}{r} 0.35 \\ 4\overline{)1.{}^{1}4^{2}0} \end{array}$$

Answer: 0.35

Questions Part 3 of 3 – Dividing decimals

19.3 Complete the following questions. Note that the expected detail in your working is demonstrated in the examples of Parts 1 and 2.

a. $1.77 \div 0.3$	b. $4.7 \div 5$	c. $2.4 \div 0.5$	d. $2.6 \div 2$
e. $0.87 \div 0.3$	f. $0.234 \div 0.04$	g. $0.78 \div 0.4$	h. $5.85 \div 0.03$
i. $2.79 \div 3$	j. $3.87 \div 0.3$	k. $2.36 \div 0.4$	l. $0.9 \div 5$
m. $35.4 \div 6$	n. $4.89 \div 3$	o. $4.89 \div 0.03$	p. $0.86 \div 0.04$
q. $0.0316 \div 0.02$	r. $3.7 \div 2$	s. $0.08 \div 0.05$	t. $4.74 \div 0.6$

Answers

a. 5.9 b. 0.94 c. 4.8 d. 1.3 e. 2.9 f. 5.85 g. 1.95 h. 195 i. 0.93 j. 12.9 k. 5.9 l. 0.18 m. 5.9 n. 1.63 o. 163 p. 21.5 q. 1.58 r. 1.85 s. 1.6 t. 7.9

20 calculating a percentage of a number

Questions Part 1 of 1

20.2 Complete the following questions. Note that the expected detail in your working is demonstrated in the example on the right.

a. 7% of 15	b. 5% of 59	c. 30% of 56	d. 80% of 59
e. 80% of 74	f. 3% of 59	g. 4% of 94	h. 60% of 64
i. 40% of 5	j. 8% of 47	k. 40% of 13	l. 20% of 6
m. 60% of 41	n. 70% of 71	o. 5% of 26	p. 2% of 32
q. 4% of 91	r. 9% of 8	s. 30% of 88	t. 80% of 12

Answers

a. 1.05 b. 2.95 c. 16.8 d. 47.2 e. 59.2 f. 1.77 g. 3.76 h. 38.4 i. 2 j. 3.76 k. 5.2 l. 1.2 m. 24.6 n. 49.7 o. 1.3 p. 0.64 q. 3.64 r. 0.72 s. 26.4 t. 9.6

Helpful Information

Strategy for Finding any Percentage of a Number

1. Convert the percentage to a decimal
2. Multiply the number by the decimal

Example

Question: Calculate 7% of 15.

Thought process: Using the above strategy we have…

$7\% \text{ of } 15 = 0.07 \times 15$

$= 1.05$

$\begin{array}{r} {}^{3}15 \\ \times\ 7 \\ \hline 105 \end{array}$

Answer: 1.05

Return to contents page

21 substituting into a one-step expression

Questions Part 1 of 2 – Substituting into expressions involving addition and subtraction

21a Complete the following substitutions. Include working out as shown in the example.

a. Substitute $x = 2$ into $x + 4$ and evaluate

b. Substitute $x = 7$ into $x - 2$ and evaluate

c. Substitute $x = 8$ into $x - 1$ and evaluate

d. Substitute $x = 9$ into $x - 3$ and evaluate

e. Substitute $x = 2$ into $x + 8$ and evaluate

f. Substitute $x = 1$ into $x + 1$ and evaluate

g. Substitute $x = 4$ into $x - 1$ and evaluate

h. Substitute $x = 5$ into $x + 8$ and evaluate

i. Substitute $x = 12$ into $x + 7$ and evaluate

j. Substitute $x = 8$ into $x - 7$ and evaluate

k. Substitute $x = 4$ into $x + 5$ and evaluate

l. Substitute $x = 11$ into $x + 2$ and evaluate

m. Substitute $x = 6$ into $x - 6$ and evaluate

n. Substitute $x = 0$ into $x + 7$ and evaluate

o. Substitute $x = 2$ into $x + 5$ and evaluate

Answers

a. 6 b. 5 c. 7 d. 6 e. 10 f. 2 g. 3 h. 13 i. 19 j. 1 k. 9 l. 13 m. 0 n. 7 o. 7

Helpful Information

A **pronumeral** is the name given to a letter used to represent a number. You might find it interesting that the word pronumeral comes from two words: *pro* meaning 'stands for' and *numeral* meaning 'number'. The letter x is the most commonly used pronumeral, though any letter or even symbol can be used.

An **algebraic expression** is some combination of numbers, pronumerals and mathematical symbols. For example, x, $x + 3$ and $3 - a$ are algebraic expressions.

Substitution is the process of replacing a pronumeral with a specified value. It could be helpful to think of a substitution like a swap, just like a substitution in basketball.

Evaluate means calculate.

Example

Question: Substitute $x = 2$ into $x + 4$ and evaluate.

Thought process:

Step 1: Substitute means "replace". Since $x = 2$ so we replace the x with the value 2.

$2 + 4 = 6$

Step 2: Evaluate means calculate so we calculate the value of 2+4

Answer: 6

Return to contents page

Questions Part 2 of 2 – Substituting into expressions involving multiplication and division

21b Complete the following substitutions. Include working out as shown in the example.

a. Substitute $= 7$ into $4x$ and evaluate

b. Substitute $x = 12$ into $\frac{x}{3}$ and evaluate

c. Substitute $x = 27$ into $\frac{x}{3}$ and evaluate

d. Substitute $x = 81$ into $\frac{x}{9}$ and evaluate

e. Substitute $x = 2$ into $\frac{x}{2}$ and evaluate

f. Substitute $x = 1$ into $8x$ and evaluate

g. Substitute $x = 12$ into $3x$ and evaluate

h. Substitute $x = 0$ into $\frac{x}{9}$ and evaluate

i. Substitute $x = 9$ into $7x$ and evaluate

j. Substitute $x = 8$ into $3x$ and evaluate

k. Substitute $x = 80$ into $\frac{x}{10}$ and evaluate

l. Substitute $x = 56$ into $\frac{x}{7}$ and evaluate

m. Substitute $x = 6$ into $8x$ and evaluate

n. Substitute $x = 30$ into $\frac{x}{6}$ and evaluate

o. Substitute $x = 12$ into $4x$ and evaluate

Answers

a. 28 b. 4 c. 9 d. 9 e. 1 f. 8 g. 36 h. 0 i. 63 j. 24 k. 8 l. 8 m. 48 n. 5 o. 48

Helpful Information

Additions and subtractions in algebra look extremely familiar. Multiplications and divisions look a bit different.

× Multiplications are written without the multiplication symbol.
For example, $3x$ is read as 3 multiplied by x

÷ Divisions are written as fractions.
For example, $\frac{x}{5}$ is read as x divided by 5

Examples

Question: Substitute $x = 7$ into $4x$ and evaluate
Thought process: $4x$ means 4 times x and so we have

$$4 \times 7$$
$$= 28$$

Answer: 28

Question: Substitute $x = 12$ into $\frac{x}{3}$ and evaluate
Thought process: $\frac{x}{3}$ means x divided by 3 and so we have

$$\frac{12}{3}$$
$$= 4$$

Answer: 4

22 solving one step equations

Questions Part 1 of 2 – Solving equations involving addition and subtraction

22a Solve the equations below and include working that shows your use of an opposite operation.

a. $x+9=12$	b. $x-3=15$	c. $x-7=3$	d. $x+9=16$
e. $x-9=6$	f. $x-5=3$	g. $x+8=17$	h. $x+7=19$
i. $x+4=15$	j. $x+3=15$	k. $x-7=6$	l. $x-8=4$

Answers

a. $(-9), x=3$ b. $(+3), x=18$ c. $(+7), x=10$ d. $(-9), x=7$
e. $(+9), x=15$ f. $(+5), x=8$ g. $(-8), x=9$ h. $(-7), x=12$ i. $(-4), x=11$
j. $(-3), x=12$ k. $(+7), x=13$ l. $(+8), x=12$

Helpful Information

A pronumeral in an algebraic equation is called an **unknown**. While the value of the pronumeral often starts out being unknown (or not specified explicitly), it is often expected that you find its value!

The equals sign is probably the most important sign in maths. The equals sign tells us that what is on the left has the same value as what is on the right.

The goal of **solving** an algebraic equation is to find the value of the unknown which makes the equation true. We do this by

1. Using an opposite operation(s) and
2. Doing the "same to both sides"

We do the "same to both sides" to make sure that the value of what is on the left-hand side of the equals sign is still of equal value to what is on the right.

Examples

Question: Solve $x+9=12$ and include working that shows your use of an opposite operation.

Thought process: Following the strategy above…

$$\begin{array}{r|l} & x+9=12 \\ -9 & x=3 \end{array}$$

Answer: $x=3$

Question: Solve $x-3=15$ and include working that shows your use of an opposite operation.

Thought process: Following the strategy above…

$$\begin{array}{r|l} & x-3=15 \\ +3 & x=18 \end{array}$$

Answer: $x=18$

Questions Part 2 of 2 – Solving equations involving multiplication and division

22b Solve the equations below and include working that shows your use of an opposite operation.

a. $8x = 16$	b. $\frac{x}{6} = 10$	c. $\frac{x}{6} = 12$	d. $9x = 63$
e. $\frac{x}{4} = 10$	f. $\frac{x}{8} = 3$	g. $12x = 60$	h. $7x = 35$
i. $3x = 18$	j. $4x = 8$	k. $\frac{x}{5} = 3$	l. $\frac{x}{9} = 8$
m. $6x = 36$	n. $\frac{x}{7} = 5$	o. $7x = 21$	p. $3x = 3$

a. $(\div 8), x = 2$ b. $(\times 6), x = 60$ c. $(\times 6), x = 72$ d. $(\div 9), x = 7$
e. $(\times 4), x = 40$ f. $(\times 8), x = 24$ g. $(\div 12), x = 5$ h. $(\div 7), x = 5$
i. $(\div 3), x = 6$ j. $(\div 4), x = 2$ k. $(\times 5), x = 15$ l. $(\times 9), x = 72$ m. $(\div 6), x = 6$
n. $(\times 7), x = 35$ o. $(\div 7), x = 3$ p. $(\div 3), x = 1$

Examples

Question: Solve $8x = 16$ and include working that shows your use of an opposite operation.

Thought process: Following the strategy above…

	$8x = 16$
$\div 8$	$x = 2$

Answer: $x = 2$

Question: Solve $\frac{x}{6} = 10$ and include working that shows your use of an opposite operation.

Thought process: Following the strategy above…

	$\frac{x}{6} = 10$
$\times 6$	$x = 60$

Answer: $x = 60$

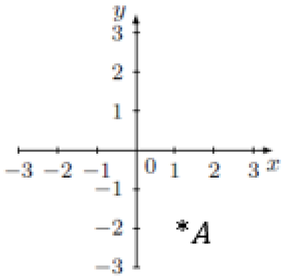
Return to contents page

23 plotting coordinates

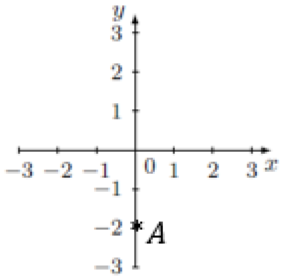
Questions Part 1 of 2 – Stating the coordinates of points on the Cartesian plane

23.1 State the coordinates of point A in each diagram.

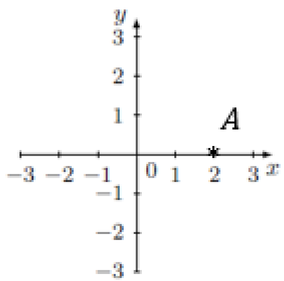
a.



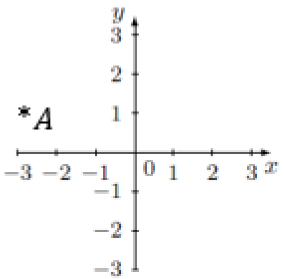
b.



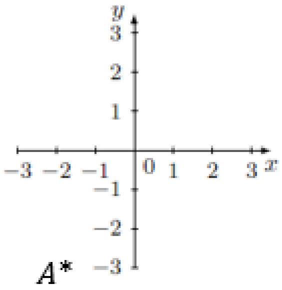
c.



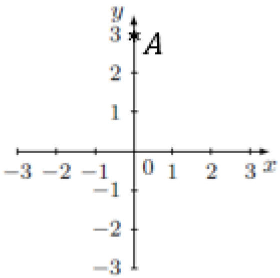
d.



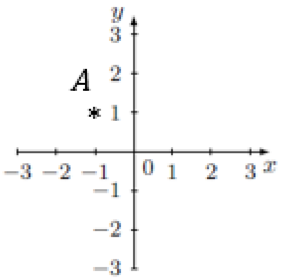
e.



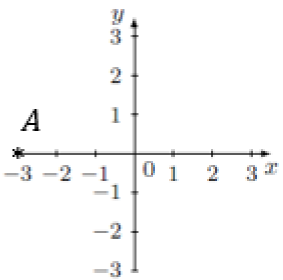
f.



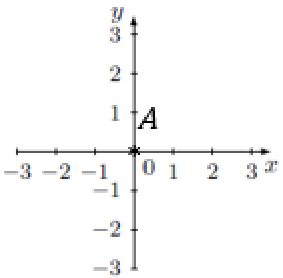
g.



h.



i.

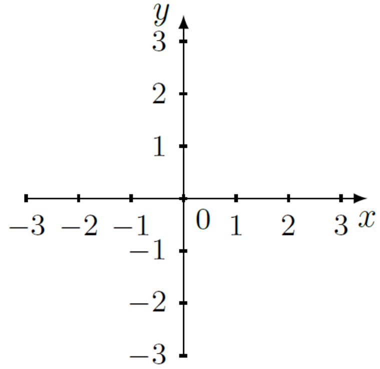


Answers

a. (1,-2) b. (0,-2) c. (2,0) d. (-3,1) e. (-2,-3) f. (0,3) g. (-1,1) h. (-3,0) i. (0,0)

Helpful Information

The **Cartesian plane** is a plane made up of an x-axis (a horizontal number line) and a y-axis (a vertical number line). An example of a Cartesian plane is below.



A **point** on the Cartesian Plane is given by a pair of integers called the **coordinates** of the point. A coordinate looks like this (x, y) where the first number is the x-coordinate (how far across) and the second number is the y-coordinate (how far up or down).

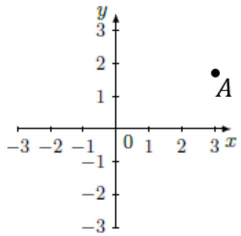
The **origin** is the intersection of the two axes and has coordinates (0,0).

Example

Question: State the coordinates of point A

Thought process: To get to point A we move 3 spaces across and 2 spaces up so the coordinates of A are (3,2)

Answer: (3,2)

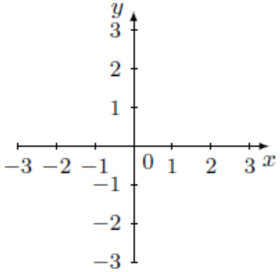


Questions Part 2 of 2 – Plotting coordinates

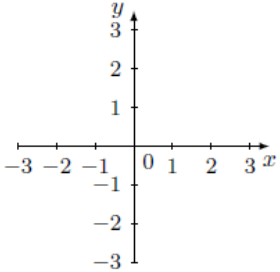
🖶 To be printed or completed using a stylus

23.2 Plot the following points on the Cartesian planes.

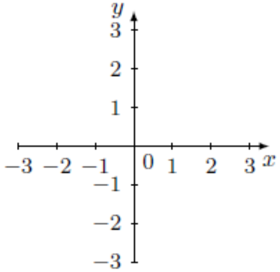
a. $A = (1,3)$



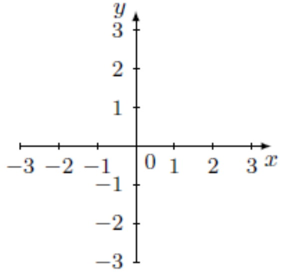
b. $B = (-1,0)$



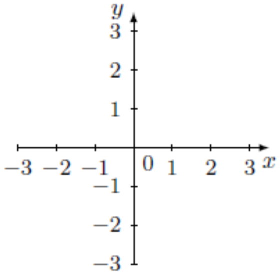
c. $C = (2,-3)$



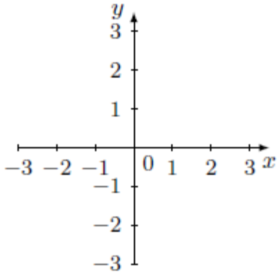
d. $D = (0,2)$



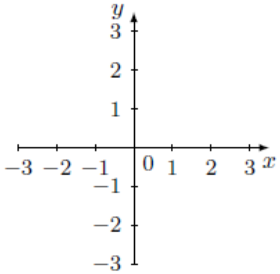
e. $E = (2,1)$



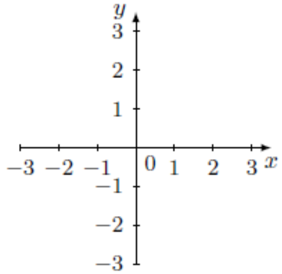
f. $F = (-1,-2)$



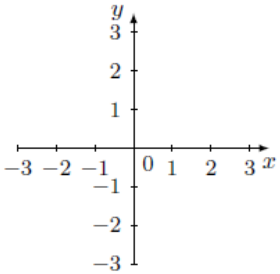
g. $G = (0,0)$



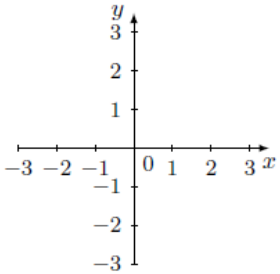
h. $H = (3,2)$



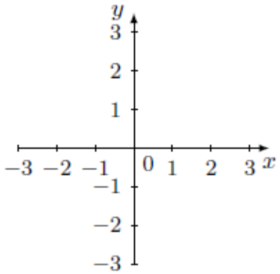
i. $I = (2,3)$



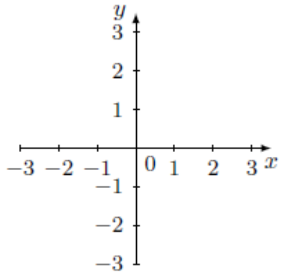
j. $J = (-1,3)$



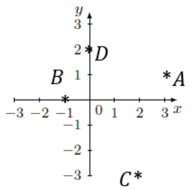
k. $K = (1,-3)$

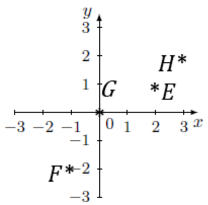


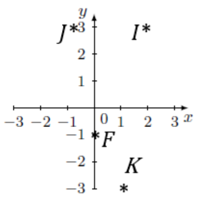
l. $L = (0,-1)$



Answers







Helpful Information

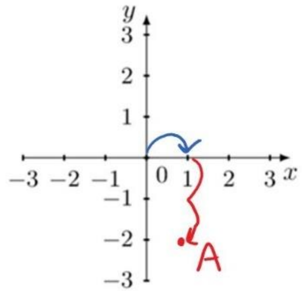
When plotting a coordinate a helpful thought process is "crawl before you climb".

Examples

Question: Plot the point $A = (1,-2)$ on the Cartesian plane below.

Thought process: The x-coordinate is 1 so we crawl across 1, the y-coordinate is -2 so we climb down 2.

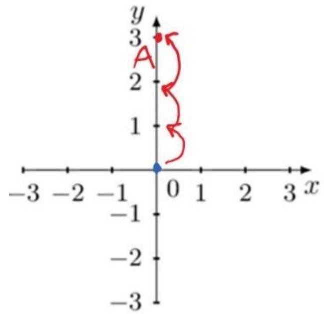
Answer:



Question: Plot the point $A = (0,3)$ on the Cartesian plane below.

Thought process: The x-coordinate is 0 so we don't crawl across at all, the y-coordinate is 3 so we climb up 3.

Answer:



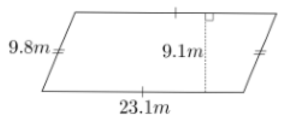
Return to contents page

24 using formulas in measurement

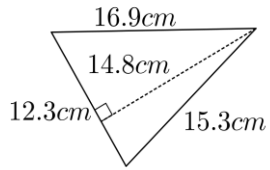
Questions Part 1 of 4 – Perimeter of parallelograms and triangles

24.1 To the nearest whole number, what is the perimeter of each shape below? You may use your calculator if you wish.

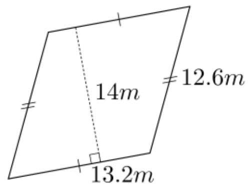
a.



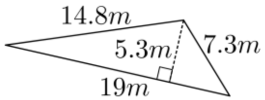
b.



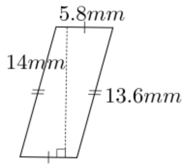
c.



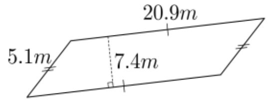
d.



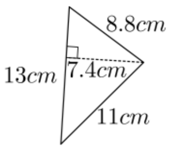
e.



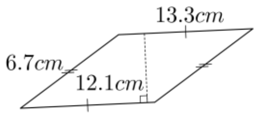
f.



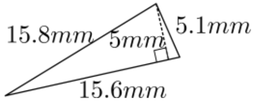
g.



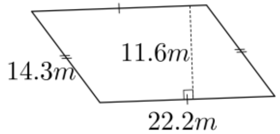
h.



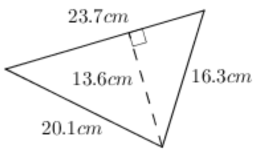
i.



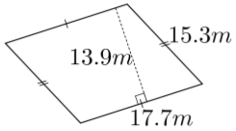
j.



k.



l.



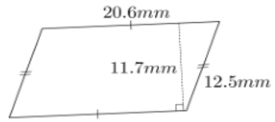
Answers

a. 66mm b. 45cm c. 52m d. 41m e. 39mm f. 52m g. 33cm h. 40cm i. 37mm j. 73m
k. 60cm l. 66m

Helpful Information

The **perimeter** of an object is the total length around its outside

Note that if a shape has little dashes on its sides this is used to show that some of the sides have equal lengths.
For example, in the shape below it looks like only 2 of the 4 lengths around the outside are given (20.6mm and 12.5mm)



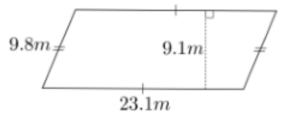
However, since the bottom length has one dash, just like the top, we know it must be 20.6mm as well. Similarly, since the left side has two dashes, just like the right side, we know it must be 12.5mm.

Strategy for finding the perimeter to the nearest whole number

1. Add up the lengths around the outside
2. Round to the nearest whole number
3. Include appropriate units

Example

Question: To the nearest whole number, what is the perimeter of the shape below?



Thought process: Using the above strategy we have…

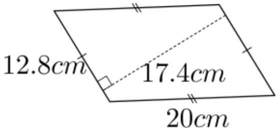
1. 23.1+9.8+23.1+9.8=65.8 (as the top side is 23.1m and the right side is 9.8m)
2. Rounding 65.8 to the nearest whole number gives 66.
3. The perimeter is 66m

Answer: 66m

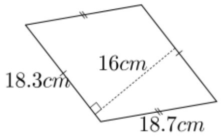
Questions Part 2 of 4 – Area of a parallelogram

24.2 Calculate the area of the parallelograms below, give your answers to the nearest whole number**.** You may use your calculator if you wish.

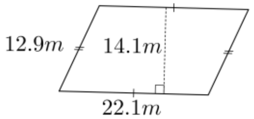
a.



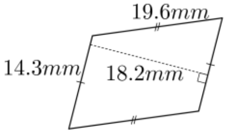
b.



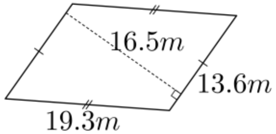
c.



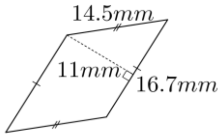
d.



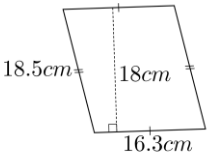
e.



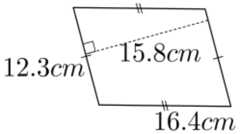
f.



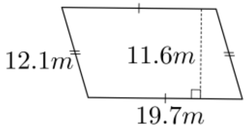
g.



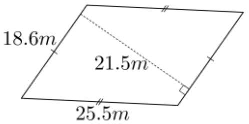
h.



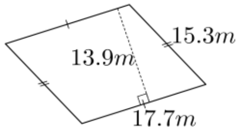
i.



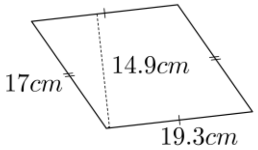
j.



k.



l.



Answers

a. $223cm^2$ b. $293cm^2$ c. $312m^2$ d. $260mm^2$ e. $224m^2$ f. $184mm^2$ g. $293cm^2$ h. $194cm^2$

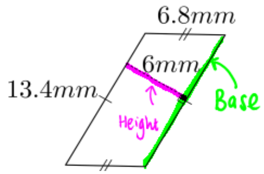
i. $229m^2$ j. $400m^2$ k. $246m^2$ l. $288cm^2$

Helpful Information

A **parallelogram** is a quadrilateral (four sided shape) with two pairs of parallel sides.

The formula for the area of a parallelogram is $A = b \times h$

The most important point to remember when using this formula is that the base and height of the parallelogram must meet at right angles. This is shown in the picture below:

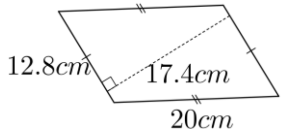


Strategy for finding the area of a parallelogram to the nearest whole number

1. Identify the base and the height making sure that they meet at right angles
2. Multiply the base and height to find the area
3. Round to the nearest whole number
4. Include appropriate units

Example

Question: Calculate the area of the parallelogram below, give your answer to the nearest whole number**.**



Thought process: Using the above strategy we have…

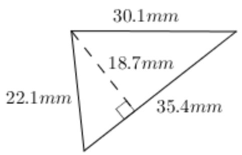
1. The base is 12.8cm and the height is 17.4cm
2. 12.8x17.4=222.72
3. 222.72 rounded to the nearest whole number is 223
4. $223cm^2$

Answer: $223cm^2$

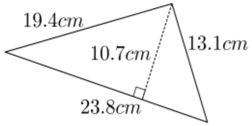
Questions Part 3 of 4 – Area of a triangle

24.3 Calculate the area of the triangles below, give your answers to the nearest whole number**.** You may use your calculator if you wish.

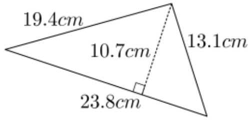
a.



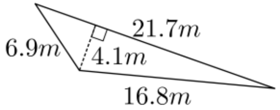
b.



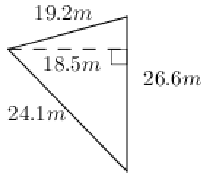
c.



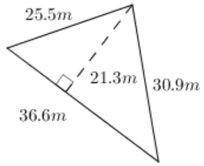
d.



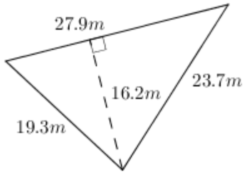
e.



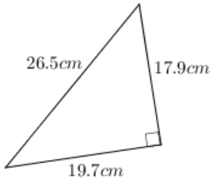
f.



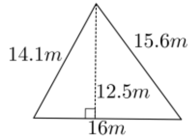
g.



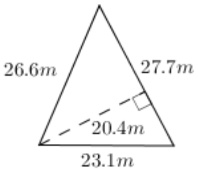
h.



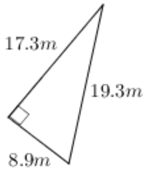
i.



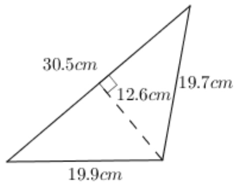
j.



k.



l.



Answers

a. 331mm^2 b. 127cm^2 c. 127cm^2 d. 44m^2 e. 246m^2 f. 390m^2 g. 226m^2 h. 176cm^2 i. 100m^2 j. 283m^2 k. 77m^2 l. 192cm^2

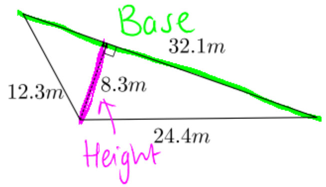
Helpful Information

A flat shape with three straight sides is called a **triangle**.

The formula for the area of a triangle is

$$A = \frac{1}{2} \times b \times h$$

The most important point to remember when using this formula is that the base and height of the triangle must meet at right angles. This is shown in the picture below:

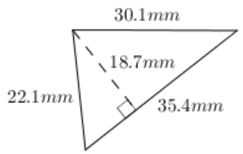


Strategy for finding the area of a triangle to the nearest whole number

1. Identify the base and the height making sure that they meet at right angles
2. Multiply half times base times height find the area
3. Round to the nearest whole number
4. Include appropriate units

Example

Question: Calculate the area of the triangle below, give your answer to the nearest whole number**.**



Thought process: Using the above strategy we have…

1. The base is 35.4mm and the height is 18.7mm
2. 0.5x35.4x18.7=330.99
3. 330.99 rounded to the nearest whole number is 331
4. 331mm^2

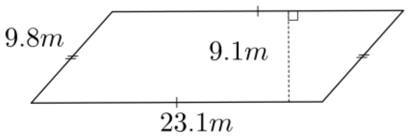
Answer: 331mm^2

Questions Part 3 of 4 – Area of a triangle

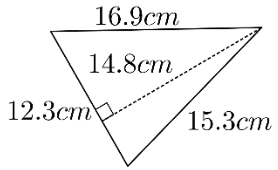
24.3 Calculate the perimeter and area of the shapes below.

Include working out to support your answers and give your answers to the nearest whole number.

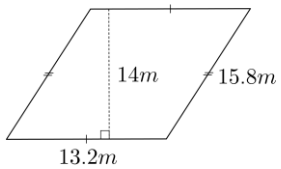
a.



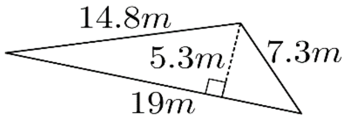
b.



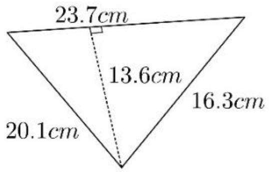
c.



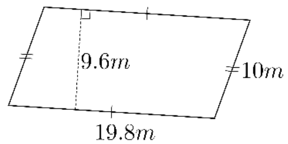
d.



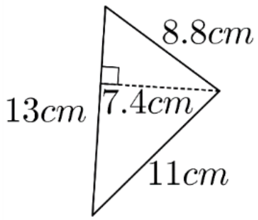
e.



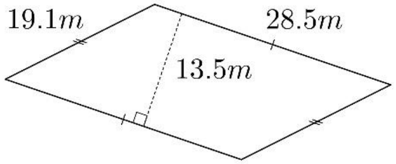
f.



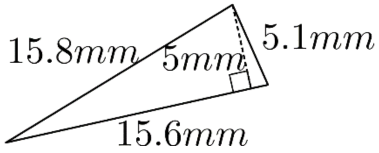
g.



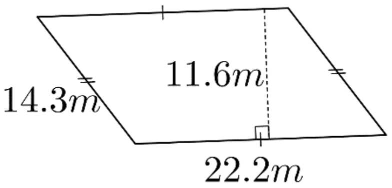
h.



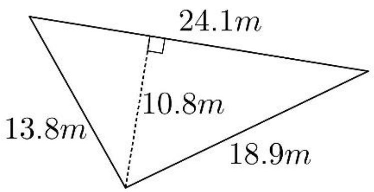
i.



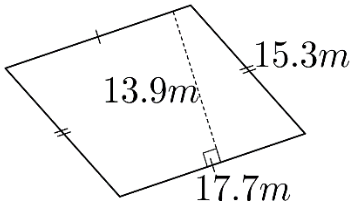
j.



k.



l.



Answers

a. P = 66m, A = 210m^2 b. P = 45cm, A = 91cm^2 c. P = 58m, A = 185m^2 d. P = 41m, A = 50m^2 e. P = 60cm, A = 161cm^2 f. P = 60m, A = 190m^2

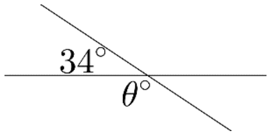
g. P = 33cm, A = 48cm^2 h. P = 95m, A = 385m^2 i. P = 37mm, A = 39mm^2 j. P = 73m, A = 258m^2 k. P = 57m, A = 130m^2 l. P = 66m, A = 246m^2

25 angles around parallel lines

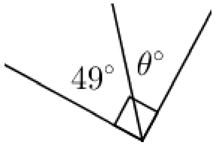
Questions Part 1 of 6 – Angles around a point

25.1 In each diagram **c**lassify the relationship between the two marked angles as complementary, supplementary or vertically opposite, then find the value of θ.

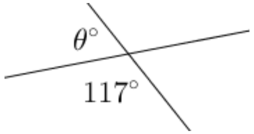
a.



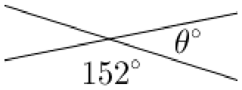
b.



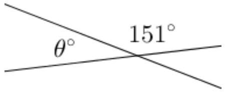
c.



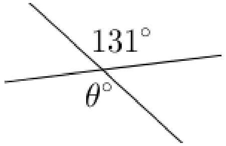
d.



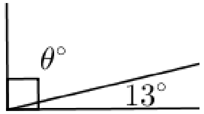
e.



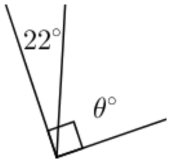
f.



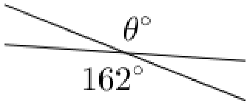
g.



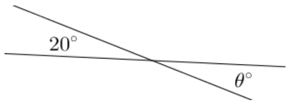
h.



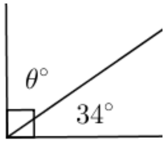
i.



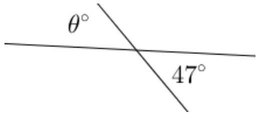
j.



k.



l.

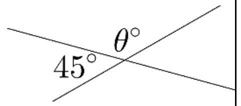


Answers

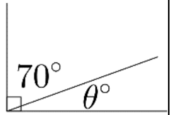
a. supplementary, θ=146 b. complementary, θ=41 c. supplementary, θ=63
d. supplementary, θ=28 e. supplementary, θ=29 f. vertically opposite, θ=131
g. complementary, θ=77 h. complementary, θ=68 i. vertically opposite, θ=162
j. vertically opposite, θ=20 k. complementary, θ=56 l. vertically opposite, θ=47

Helpful Information

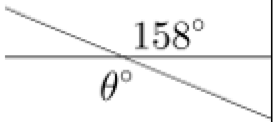
Two angles that add to 180° are called **supplementary angles**. This means that supplementary angles will form a straight line. In the diagram on the right the marked angles, 45° and θ° are **supplementary angles**.



Two angles that add to 90° are called **complementary angles**. This means that complementary angles will form a right angle. In the diagram on the right the marked angles, 70° and θ° are **complementary angles**.



When two lines intersect four angles are formed. The angles opposite each other are called **vertically opposite**. These angles are always equal (the same size). In the diagram on the right the marked angles, 158° and θ° are **vertically opposite angles**.

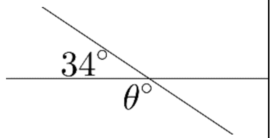


The following (somewhat silly) sentences may help you remember when to use complementary and when to use supplementary:

> You will get a compliment if you are right (complementary – right)
> What's sup bro? Talk straight with me! (supplementary – straight)

The symbol θ in each diagram is called theta and is a Greek letter. In the same way that x is often used to represent an unknown number, Greek letters are often used to represent an unknown angle.

Example



Question: Classify the relationship between the two marked angles as complementary, supplementary or vertically opposite, then find the value of θ

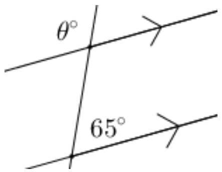
Thought process: Since the angles form a straight line they are supplementary. This means that the angles add to 180. $34 + \theta = 180$, so $\theta = 180 - 34 = 146$

Answer: supplementary, θ=146

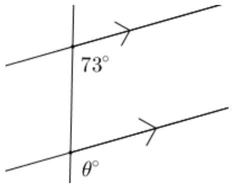
Questions Part 2 of 6 – Identifying corresponding angles

25.2 Determine which of the following pairs of angles are corresponding.

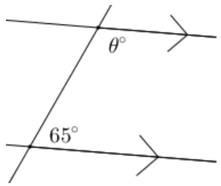
a.



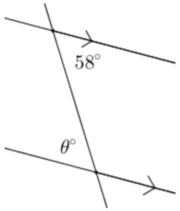
b.



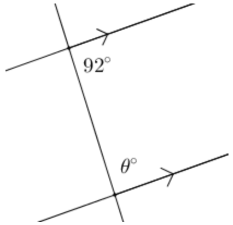
c.



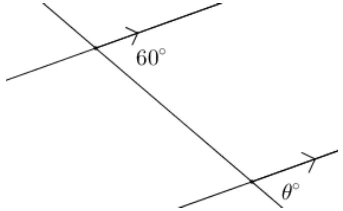
d.



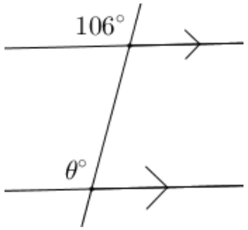
e.



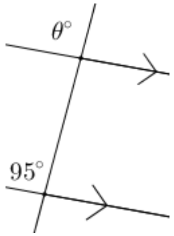
f.



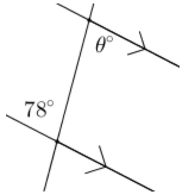
g.



h.



i.



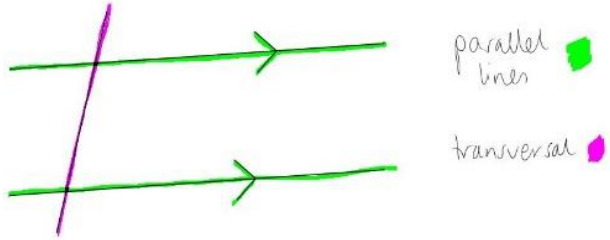
Answers

a. not corresponding b. corresponding c. not corresponding d. not corresponding
e. not corresponding f. corresponding g. corresponding h. corresponding
i. not corresponding

Helpful Information

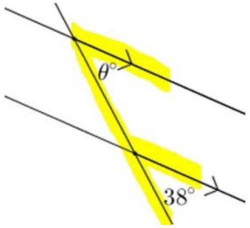
Two lines are called **parallel** if they will never meet no matter how far they are extended in either direction. Note that arrows are used to show that two lines are parallel.

A **transversal** is the name given to a line that crosses two other lines.



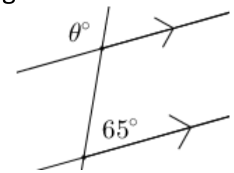
There are three key classifications of certain pairs of angles involving two lines and a transversal; corresponding, co-interior and alternate. In this subskill we will focus on corresponding angles.

Corresponding angles are in corresponding positions. In the diagram on the right the marked angles, 38° and θ° are **corresponding angles**. We say that the angles are in corresponding positions because both are "bottom right" of the intersection point. A good check to make sure you have corresponding angles is to check if they are contained within an F. The 'F' is shown on the diagram on the right. Note however that the F may look like or even



Example

Question: Are the pairs of angles marked below corresponding?

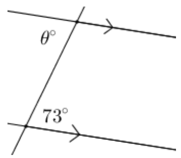


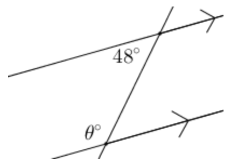
Thought process: The angle marked θ° is top left and the angle marked 65° is top right so these angles are not in corresponding positions.

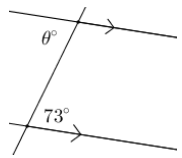
Answer: No

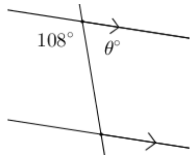
Questions Part 3 of 6 – identifying co-interior angles

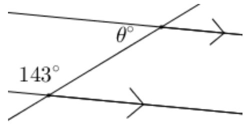
25.3 Determine which of the following pairs of angles are co-interior.

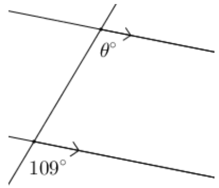
a.


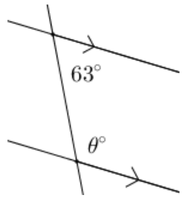
b.


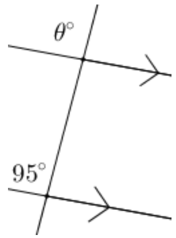
c.


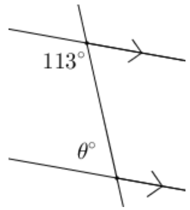
d.


e.


f.


g.


h.


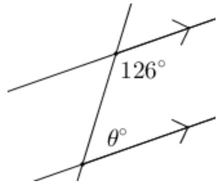
i.


Answers

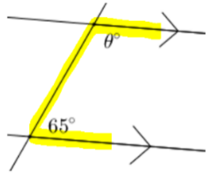
a. not co-interior b. co-interior c. not co-interior d. not co-interior e. co-interior
f. not co-interior g. co-interior h. not co-interior i. co-interior

Helpful Information

Co-interior angles are just inside each of the parallel lines and on the same side of the transversal. In the diagram on the right the marked angles, 126° and θ° are **co-interior angles**.

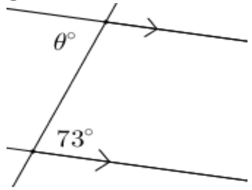


While co-interior angles are generally easy to spot, seeing if they are contained within a c is a good check. The 'c' is shown on the diagram on the right. Note however that the c may look like ɔ or even ɔ



Example

Question: Are the pairs of angles marked below co-interior?



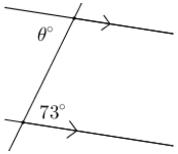
Thought process: Both angles are just inside each of the parallel lines, though they are not on the same side of the transversal so these angles are not co-interior.

Answer: No

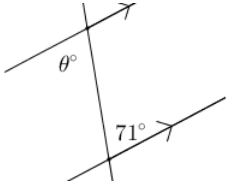
Questions Part 4 of 6 – Identifying alternate angles

25.4 Determine which of the following pairs of angles are alternate.

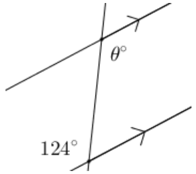
a.



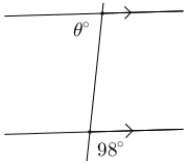
b.



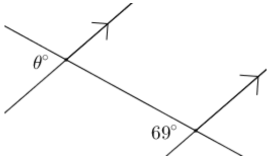
c.



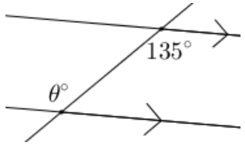
d.



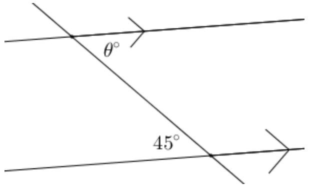
e.



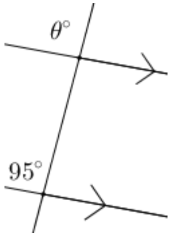
f.



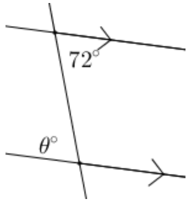
g.



h.



i.

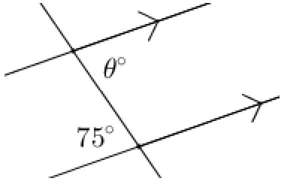


Answers

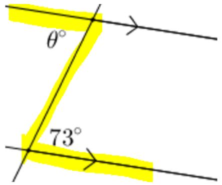
a. alternate b. alternate c. alternate d. not alternate e. not alternate f. alternate
g. alternate h. not alternate i. alternate

Helpful Information

Alternate angles are just inside each of the parallel lines and on alternate (different) sides of the transversal. In the diagram on the right the marked angles, 75° and θ° are **alternate angles**.

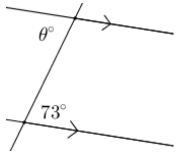


While alternate angles can be easy to spot, seeing if they are held within the letter z is a good check. The 'z' is shown on the diagram on the right. The z may look like  or even 



Example

Question: Are the pairs of angles marked below alternate?

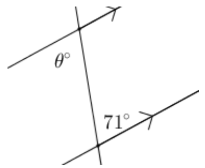


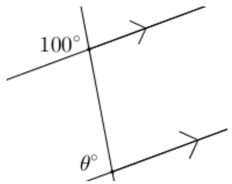
Thought process: Both angles are just inside each of the parallel lines and are on alternate sides of the transversal so these angles are alternate.

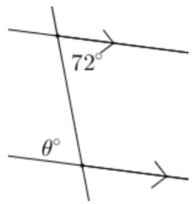
Answer: Yes

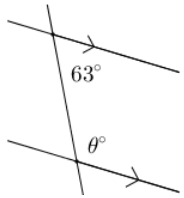
Questions Part 5 of 6 – Classifying angles as corresponding, co-interior and alternate

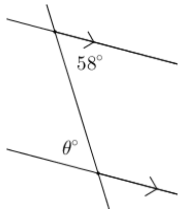
25.5 Classify the relationship between the two marked angles as co-interior, corresponding or alternate.

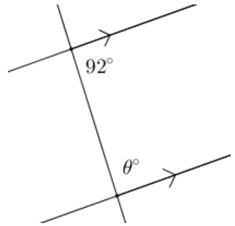
a.


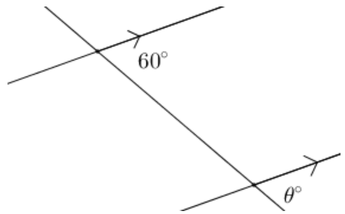
b.


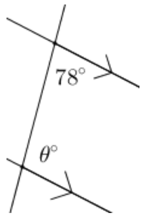
c.


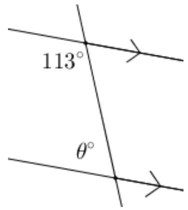
d.


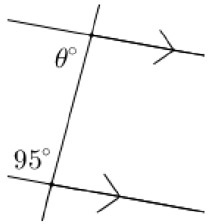
e.


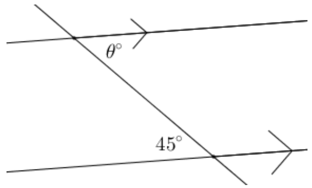
f.


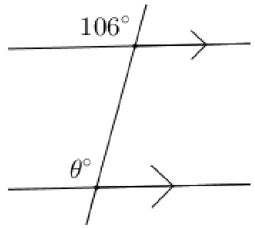
g.


h.


i.


j.


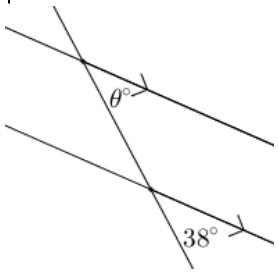
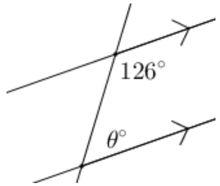
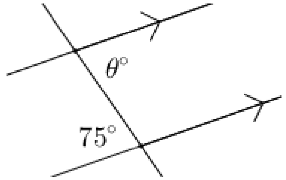
k.


l.


Answers

a. alternate b. corresponding c. alternate d. co-interior e. alternate f. co-interior
g. corresponding h. co-interior i. co-interior j. co-interior k. alternate l. corresponding

Helpful Information

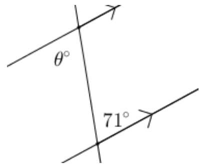
<u>Corresponding angles</u> are in corresponding positions 	<u>Co-interior angles</u> are just inside each of the parallel lines on the same side of the transversal 	<u>Alternate angles</u> are just inside each of the parallel lines and on alternate sides of the transversal 

Strategy for classifying angles as corresponding, co-interior or alternate

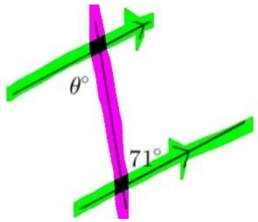
1. Mark the two parallel lines in one colour
2. Mark the transversal in another colour
3. If
   a. The two marked angles are both just inside each parallel line then look to see if
      i. They are on the same side of the transversal (co-interior)
      ii. They are on alternate sides of the transversal (alternate)
   b. If they are not both just inside the parallel lines look to see if they are in corresponding positions (corresponding)

Example

Question: Classify the relationship between the two marked angles as co-interior, corresponding or alternate.

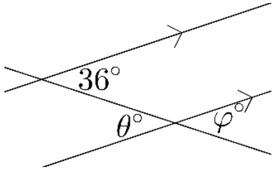


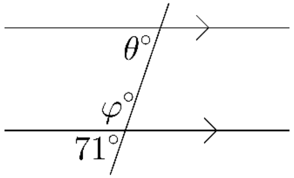
Thought process: Using the above strategy we have…
Both angles are just inside each parallel line, and they are on alternate sides of the transversal.
Answer: Alternate

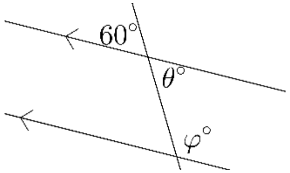


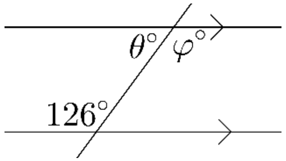
Questions Part 6 of 6 – Classifying and determining unknown angles around parallel lines

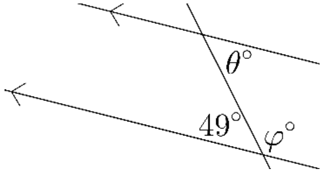
25.6 In each diagram,
i. determine the values of θ and φ and,
ii. state the relationship between θ and φ

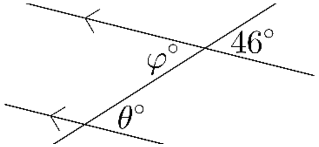
a.


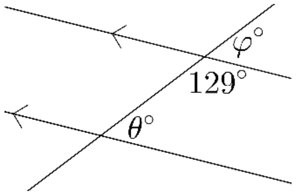
b.


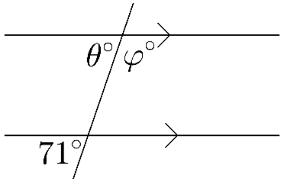
c.


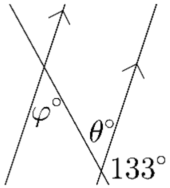
d.


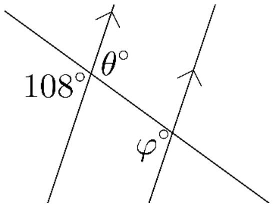
e.


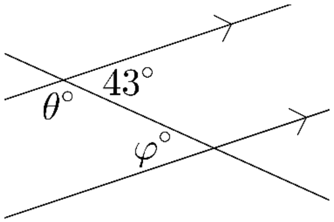
f.


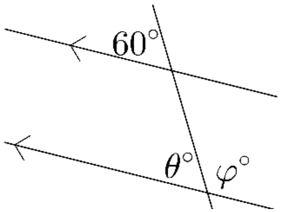
g.


h.


i.


j.


k.


l.


Answers

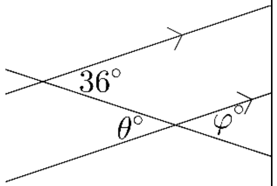
a.i. $\theta = 36, \varphi = 36$ ii. vertically opposite b.i. $\theta = 71, \varphi = 109$ ii. co-interior
c.i. $\theta = 60, \varphi = 120$ ii. co-interior d.i. $\theta = 54, \varphi = 126$ ii. supplementary
e.i. $\theta = 49, \varphi = 131$ ii. co-interior f.i. $\theta = 46, \varphi = 46$ ii. alternate
g.i. $\theta = 51, \varphi = 51$ ii. corresponding h.i. $\theta = 71, \varphi = 109$ ii. supplementary
i.i. $\theta = 47, \varphi = 47$ ii. alternate j.i. $\theta = 108, \varphi = 108$ ii. alternate
k.i. $\theta = 137, \varphi = 43$ ii. co-interior l.i. $\theta = 60, \varphi = 120$ ii. supplementary

Helpful Information

- **Supplementary** angles add to 180°
- **Vertically opposite** angles are equal in value
- **Corresponding** angles are equal in value
- **Alternate** angles are equal in value
- **Co-interior** angles add to 180°

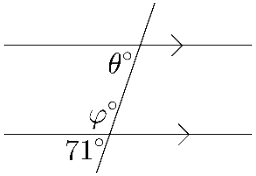
Examples

Question: For the diagram on the right,
i. determine the values of θ and φ and,
ii. state the relationship between θ and φ



Thought process: The angle marked 36° and θ are alternate angles (contained within a z) and are equal. So $\theta = 36$. θ and φ are vertically opposite angles (contained within an x) and are equal in value. So $\varphi = 36$
Answer: i. $\theta = 36$ and $\varphi = 36$. ii. θ and φ are vertically opposite.

Question: For the diagram on the right,
i. determine the values of θ and φ and,
ii. state the relationship between θ and φ



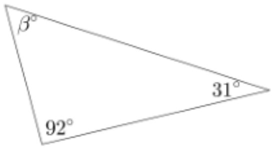
Thought process: The angle marked 71° and θ are corresponding angles (contained within an F) and are equal. So $\theta = 71$. The angle marked 71° and φ are supplementary (on a straight line) and add t0 180°. So $\varphi = 180 - 71 = 109$. θ and φ are co-interior angles (contained with in a c).
Answer: i. $\theta = 71$ and $\varphi = 109$. ii. θ and φ are co-interior angles.

26 angles in a triangle and classifying triangle

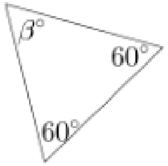
Questions Part 1 of 4 – Finding the unknown angle in a triangle

26.1 Calculate the unknown angle in each triangle**.**

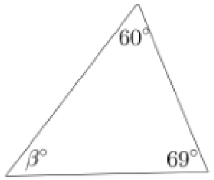
a.



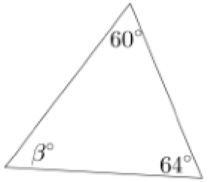
b.



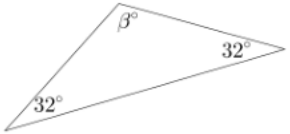
c.



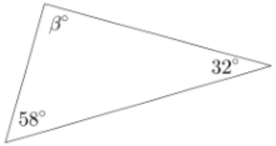
d.



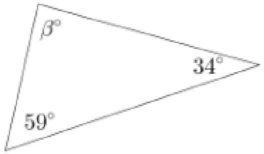
e.



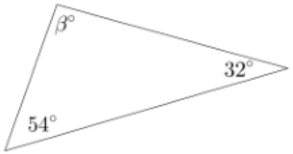
f.



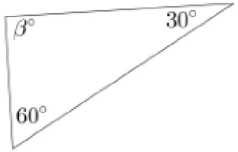
g.



h.



i.



Answers

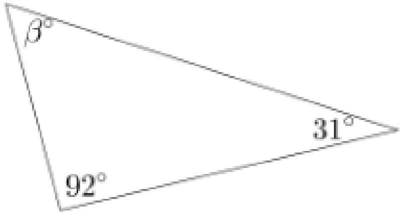
a. 57 b. 60 c. 51 d. 56 e. 116 f. 90 g. 87 h. 94 i. 90

Helpful Information

The sum of the three angles in any triangle is 180°.

Example

Question: Calculate the unknown angle in the triangle below.



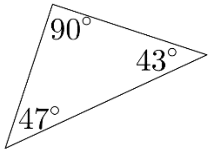
Thought process: The sum of the three angles in any triangle is 180°. Since $92 + 31 = 123$ we must have $\beta = 180 - 123 = 57$

Answer: 57

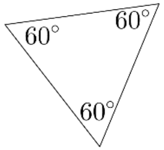
Questions Part 2 of 4 – Classifying triangles

26.2 Classify each triangle using one or more of the classifications; equilateral, isosceles, scalene and right.

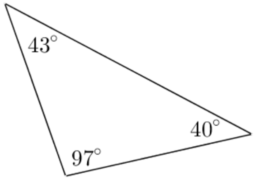
a.



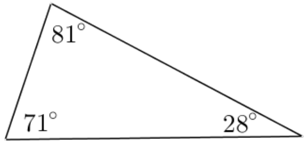
b.



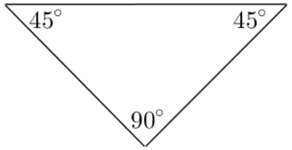
c.



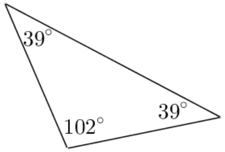
d.



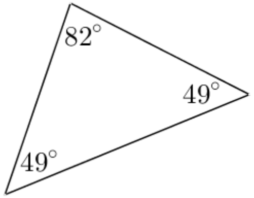
e.



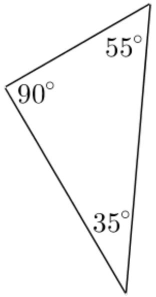
f.



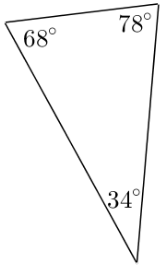
g.



h.



i.



Answers

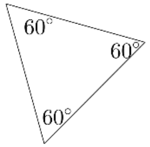
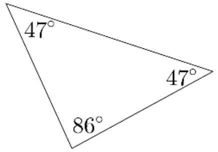
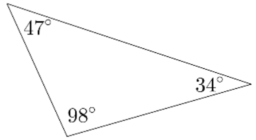
a. scalene, right b. equilateral c. scalene d. scalene e. isosceles, right f. isosceles
g. isosceles h. scalene, right i. scalene

Helpful Information

Every triangle is one of the following types:

- **Equilateral triangle**: All three angles equal to 60°
- **Isosceles triangle**: Exactly two equal angles.
- **Scalene triangle**: All three angles are different.

An example of each triangle is shown in the table below:

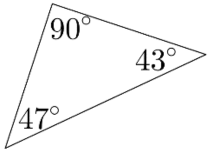
Equilateral	Isosceles	Scalene
		

As well as being one of the above types, a triangle is also either right angled or non-right angled.

- **Right triangle**: Triangle contains one angle equal to 90°
- **Non-right triangle**: There is no angle in the triangle equal to 90°

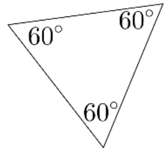
Examples

Question: Classify the triangle on the right using one or more of the classifications equilateral, isosceles, scalene and right.



Thought process: All angles are different so this is a scalene triangle. The triangle also contains one angle equal to 90° so is right angled
Answer: Scalene, right angled

Question: Classify the triangle on the right using one or more of the classifications equilateral, isosceles, scalene and right.



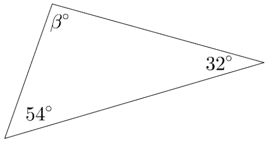
Thought process: All angles are equal to 60° so this triangle is equilateral. As there is no angle in the triangle equal to 90° it is non-right angled
Answer: Equilateral

Return to contents page

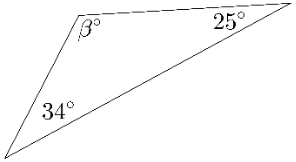
Questions Part 3 of 4 – Finding unknown angles and classifying triangles

26.3 Calculate the unknown angle in each triangle and then classify the triangle using one or more of the following words: scalene, right, isosceles or equilateral.

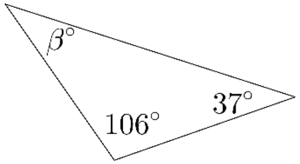
a.



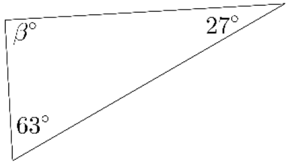
b.



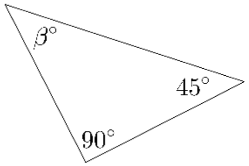
c.



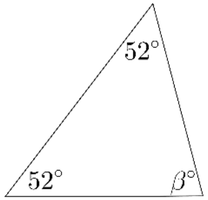
d.



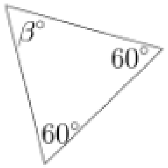
e.



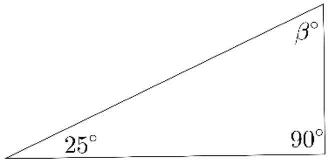
f.



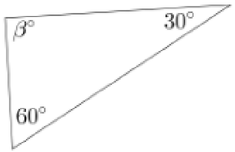
g.



h.



i.

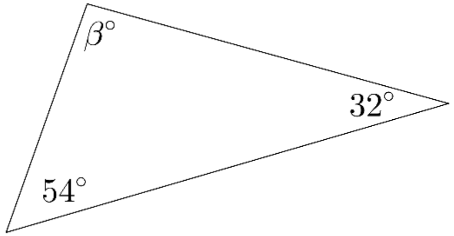


Answers

a. $\beta = 94$, scalene b. $\beta = 121$, scalene c. $\beta = 37$, isosceles d. $\beta = 90$, scalene, right
e. $\beta = 45$, isosceles, right f. $\beta = 76$, isosceles g. $\beta = 60$, equilateral h. $\beta = 65$, scalene, right
i. $\beta = 90$, scalene, right

Example

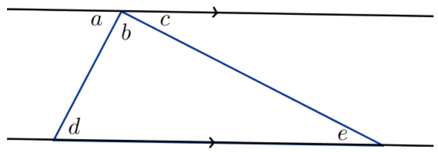
Question: Calculate the unknown angle in the triangle below and then classify the triangle using one or more of the following words: scalene, right, isosceles or equilateral.



Thought process: The sum of the three angles in any triangle is 180°. Since $54 + 32 = 86$ we must have $\beta = 180 - 86 = 94$. All angles are different so this is a scalene triangle. As there is no angle in the triangle equal to 90° it is non-right angled.
Answer: $\beta = 94$, scalene

Questions Part 4 of 4 – Understanding why the sum of the angles in a triangle is 180°

26.4 The picture to the right can be used to show why the sum of the angles in a triangle is 180°**.** Can you explain it?



Answers

Because a, b and c form a straight line a+b+c=180°. Since the lines are parallel there are two pairs of alternate angles and so a=d and c=e. Since a=d and c=e we can replace the a and c in a+b+c=180° with d and e. Therefore, d+b+e=180° showing that the sum of the three angles in the triangle is 180°.

27 probability and sample space

Questions

27.1 Complete the following questions.

1. A bag contains 8 balls numbered 1 to 8. A ball is randomly selected.
   a. What is the sample space?
   b. What is the probability of selecting a ball with a number that is less than 5?
2. A bag contains 11 balls numbered 1 to 11. A ball is randomly selected.
   a. What is the sample space?
   b. What is the probability of selecting a ball with a number that is a multiple of 5?
3. A bag contains 14 balls numbered 1 to 14. A ball is randomly selected.
   a. What is the sample space?
   b. What is the probability of selecting a ball with an odd number?
4. A bag contains 13 balls numbered 1 to 13. A ball is randomly selected.
   a. What is the sample space?
   b. What is the probability of selecting a ball with a number that is greater than 2?
5. A bag contains 9 balls numbered 1 to 9. A ball is randomly selected.
   a. What is the sample space?
   b. What is the probability of selecting a ball with an even number?
6. A bag contains 10 balls numbered 1 to 10 A ball is randomly selected.
   a. What is the sample space?
   b. What is the probability of selecting a ball with a number that is less than 3?
7. A bag contains 12 balls numbered 1 to 12. A ball is randomly selected.
   a. What is the sample space?
   b. What is the probability of selecting a ball with a number that is a multiple of 3?
8. A bag contains 8 balls numbered 1 to 8. A ball is randomly selected.
   a. What is the sample space?
   b. What is the probability of selecting a ball with a number that is greater than 5?

Answers

1.a. {1,2,3,4,5,6,7,8} b. $\frac{1}{2}$ 2.a. {1,2,3,4,5,6,7,8,9,10,11} b. $\frac{2}{11}$
3.a. {1,2,3,4,5,6,7,8,9,10,11,12,13,14} b. $\frac{1}{2}$ 4.a. {1,2,3,4,5,6,7,8,9,10,11,12,13} b. $\frac{9}{13}$
5.a. {1,2,3,4,5,6,7,8,9} b. $\frac{4}{9}$ 6.a. {1,2,3,4,5,6,7,8,9,10} b. $\frac{1}{5}$ 7. {1,2,3,4,5,6,7,8,9,10,11,12} b. $\frac{1}{3}$
8.a. {1,2,3,4,5,6,7,8} b. $\frac{3}{8}$

Helpful Information

Probability is the chance that something will happen.

In probability we use the word **outcome** to talk about something that can happen.
For example, when rolling a six-sided dice the possible **outcomes** are 1,2,3,4,5 or 6.

An **event** is some collection of possible outcomes. For example, when rolling a six-sided dice an event could be 'rolling a number smaller than 5' for which the outcomes are rolling a 1,2,3 or 4.

Sample space is the list of all possible outcomes. The sample space is most correctly written in curly brackets. For example, if rolling a six-sided dice, the sample space is $\{1,2,3,4,5,6\}$

Probability is calculated using

$$P(\text{event}) = \frac{\text{the number of favourable outcomes}}{\text{the total number of outcomes}}$$

Note: Since the number of favourable outcomes is always less than or equal to the total number of outcomes probabilities are always numbers between 0 and 1.

Example

Question: A bag contains 8 balls numbered 1 to 8. A ball is randomly selected.
a. What is the sample space?
b. What is the probability of selecting a ball that is less than 5?

Thought process:

a. The sample space is the list of all possible outcomes

$$\{1,2,3,4,5,6,7,8\}$$

b. The favourable outcomes in the sample space are underlined

$$\{\underline{1},\underline{2},\underline{3},\underline{4},5,6,7,8\}$$

Using the probability formula have P(less than 5)=$\frac{4}{8} = \frac{1}{2}$

Answer: a. {1,2,3,4,5,6,7,8} b. $\frac{1}{2}$

28 statistics

Questions Part 1 of 9 – Ordering numbers	
28.1 Order the following sets of numbers from smallest to largest. a. 4, 7, 9, 0, 3, 7, 4 b. 8, 1, 2, 6, 1 c. 3, 5, 3, 9, 3 d. 9, 1, 7, 0, 2, 5 e. 2, 6, 9, 2, 2, 1, 4, 1, 4 f. 4, 1, 5, 0, 8, 7 g. 2, 6, 2, 0, 4 h. 6, 6, 1, 0, 9 i. 3, 1, 0, 8, 3, 5 *Answers* a. 0, 3, 4, 4, 7, 7, 9 b. 1, 1, 2, 6, 8 c. 3, 3, 3, 5, 9 d. 0, 1, 2, 5, 7, 9 e. 1, 1, 2, 2, 2, 4, 4, 6, 9 f. 0, 1, 4, 5, 7, 8 g. 0, 2, 2, 4, 6 h. 0, 1, 6, 6, 9 i. 0, 1, 3, 3, 5, 8	The median is the middle value of an ordered set of data. The first sub-skill for finding the median is being able to order data from smallest to largest. *Example* **Question:** Order the following set of numbers from smallest to largest 4, 7, 9, 0, 3, 7, 4 **Thought process:** The smallest number in the set is 0, the 3, 4, 4, 7, 7, 9. To check that we haven't missed any numbers we count the numbers in the original list, 7, and count the numbers in our ordered list – 7 too! **Answer:** 0, 3, 4, 4, 7, 7, 9

Return to contents page

Questions Part 2 of 9 – Finding the number halfway between two numbers

28.2 What number is exactly halfway between each pair of numbers?

a. 2 and 9	b. 2 and 4	c. 3 and 8
d. 2 and 2	e. 2 and 3	f. 3 and 6
g. 4 and 6	h. 5 and 8	i. 2 and 8
j. 3 and 5	k. 1 and 6	l. 4 and 4

Answers

a. 5.5 b. 3 c. 5.5 d. 2 e. 2.5 f. 4.5 g. 5 h. 6.5 i. 5 j. 4 k. 3.5 l. 4

Helpful Information

Sometimes the halfway point is obvious, for example halfway between 2 and 3 is 2.5 and halfway between 13 and 15 is 14. Though sometimes it is a bit harder, for example finding halfway between 7 and 15 or halfway between 2 and 11 isn't so easy.

Below gives two strategies for finding the number halfway between more difficult pairs.

Strategy 1 for finding the halfway point between two numbers

1. Find the difference between the numbers
2. Halve this difference
3. Add half this difference to the starting number
4. Check that this number is the same distance from the final number.

Strategy 2 for finding the halfway point between two numbers

1. Calculate the mean of the two numbers.

The advantage of using Strategy 1 is that it is quite intuitive (it makes good sense) where the advantage of using Strategy 2 is that it is quite simple to remember.

Examples

Question: Calculate the number halfway between 2 and 9

Thought process: Following Strategy 1 above we have

1. $9 - 2 = 7$
2. $7 \div 2 = 3.5$
3. $2 + 3.5 = 5.5$
4. $5.5 + 3.5 = 9$

Answer: 5.5

Question: Calculate the number halfway between 3 and 12

Thought process: Following Strategy 2 above we calculate the mean of 3 and 12. First we calculate the sum, 3+12=15. Then we divide the sum by the number of numbers, 15÷2=7.5

Answer: 7.5

Questions	Helpful Information
Questions Part 3 of 9 – Calculating the median – odd amount of numbers **28.3** Calculate the median for the following sets of numbers. a. 3, 7, 2, 0, 7 b. 5, 9, 2, 2, 7, 9, 6 c. 4, 8, 3, 4, 1, 1, 0 d. 7, 6, 8, 9, 6, 0, 0, 1, 1 e. 3, 0, 1, 1, 7 f. 6, 7, 7, 4, 1, 3, 9 g. 1, 3, 5, 0, 1 h. 1, 4, 1, 1, 9, 4, 5 i. 2, 5, 3, 3, 6, 7, 6 *Answers* a. 3 b. 6 c. 3 d. 6 e. 1 f. 6 g. 1 h. 4 i. 5	*Helpful Information* The **median** is the middle value of the ordered data. *Example* **Question:** Calculate the median for the following set of numbers **3, 7, 2, 0, 7** **Thought process:** We first order the data 0, 2, <u>3</u>, 7, 7 The median will be the middle number which is 3. **Answer:** 3
Questions Part 4 of 9 – Calculating the median – even amount of numbers **28.4** Calculate the median for the following sets of numbers. a. 9, 2, 7, 0, 2, 5 b. 4, 9, 3, 8, 11, 1 c. 6, 7, 1, 0, 3, 2, 3, 6 d. 7, 1, 2, 2 e. 3, 0, 3, 7, 8, 9 f. 2, 9, 12, 3, 8, 6, 7, 1 g. 4, 4, 2, 3, 1, 6 h. 2, 0, 9, 8, 9, 2 i. 3, 3, 1, 0, 1, 4, 0, 5 *Answers* a. 3.5 b. 6 c. 3 d. 2 e. 5 f. 6.5 g. 3.5 h. 5 i. 2	*Helpful Information* The **median** is the middle value of the ordered data. If there is an even number of data points the median is the number exactly half way between the two middle numbers. *Example* **Question:** Calculate the median for the following set of numbers **9, 2, 7, 0, 2, 5** **Thought process:** We first order the data 0, 2, <u>2, 5</u>, 7, 9 The median will be halfway between the two middle numbers. The difference between 2 and 5 is 3 so the halfway mark is at 2+1.5=3.5 (check 3.5+1.5=5). **Answer:** 3.5
Questions Part 5 of 9 – Calculating the median – any amount of numbers **28.5** Calculate the median for the following sets of numbers. a. 2, 6, 8, 0, 5 b. 6, 9, 3, 7, 11, 6 c. 3, 8, 9, 0, 6, 1, 3 d. 5, 8, 7, 6, 5, 0, 1, 1 e. 4, 0, 5, 0, 8, 7 f. 8, 1, 4, 5, 1, 0, 0 g. 5, 1, 1, 6, 0, 8, 6, 3 h. 1, 7, 1, 4, 5 i. 6, 9, 7, 8, 0 j. 9, 6, 9, 8, 3 k. 8, 1, 0, 8, 4, 5 l. 7, 2, 1, 0, 9 *Answers* a. 5 b. 6.5 c. 3 d. 5 e. 4.5 f. 1 g. 4 h. 4 i. 7 j. 8 k. 4.5 l. 2	*Helpful Information* The **median** is the middle value of the ordered data. If there is an even number of data points the median is the number exactly half way between the two middle numbers.

Questions Part 6 of 9 – Calculating the mean

28.6 Calculate the mean for the following sets of numbers. Give the mean to one decimal place where appropriate.

a. 9, 2, 7, 0, 2, 5	b. 6, 9, 3, 7, 11, 6	c. 3, 8, 9, 0, 6, 1, 3
d. 5, 8, 7, 6, 5, 0, 1, 1	e. 4, 0, 5, 0, 8, 7	f. 8, 1, 4, 5, 1, 0, 0
g. 5, 1, 1, 6, 0, 8, 6, 3	h. 1, 7, 1, 4, 5	i. 6, 9, 7, 8, 0
j. 9, 6, 9, 8, 3	k. 8, 1, 0, 8, 4, 5	l. 7, 2, 1, 0, 9

Answers

a. 4.2 b. 7 c. 4.3 d. 4.1 e. 4 f. 2.7 g. 3.8 h. 3.6 i. 6 j. 7 k. 4.3 l. 3.8

Helpful Information

The **sum** of a group of numbers is found by adding the numbers together.

The **mean** is the sum of all the data points divided by the number of data points.

Example

Question: Calculate the mean for the following set of numbers. Give the mean to one decimal place where appropriate.

9, 2, 7, 0, 2, 5

Thought process: We calculate the sum of the data points: 9+2+7+0+2+5=25. There are 6 data points and 25÷6=4.166.. When rounded to one decimal place this is 4.2

Answer: 4.2

Questions Part 7 of 9 – Calculating the mode

28.7 Calculate the mode for the data sets below.

a. 2, 6, 8, 2, 5	b. 5, 9, 3, 7, 11, 6	c. 3, 8, 9, 0, 6, 6, 3
d. 5, 8, 7, 6, 5, 4, 1, 1	e. 8, 1, 3, 16	f. 8, 1, 4, 5, 1, 0, 0
g. 5, 1, 1, 6, 0, 8, 6, 3	h. 1, 7, 1, 4, 5	i. 6, 9, 7, 8, 0
j. 9, 6, 9, 8, 3	k. 8, 1, 0, 8, 4, 5	l. 7, 2, 1, 0, 9
m. 4, 9, 3, 8, 11, 1	n. 5, 9, 2, 2, 7, 9, 6	o. 2, 9, 12, 3, 8, 6, 7, 1

Answers

a. 2 b. no mode c. 3 and 6 d. 1 and 5 e. no mode f. 0 and 1 g. 1 and 6 h. 1 i. no mode j. 9 k. 8 l. no mode m. no mode n. 2 and 9 o. no mode

Helpful Information

The **mode** is the value (or values) which occur the most.

Examples

Question: Calculate the mode for the data set 2, 6, 8, 2, 5.
Thought process: The mode is the value which occurs the most. Ordering the data gives us 2, 2, 5, 6, 8. We can now easily see that 2 occurs more than any other value.
Answer: 2

Question: Calculate the mode for the data set 5, 9, 3, 7, 11, 6.
Thought process: The mode is the value which occurs the most. Ordering the data gives us 3, 5, 6, 7, 9, 11. We can now easily see that no number occurs more than any other.
Answer: No mode

Question: Calculate the mode for the data set 3, 8, 9, 0, 6, 6, 3.
Thought process: The mode is the value which occurs the most. Ordering the data gives us 0, 3, 3, 6, 6, 8, 9. We can now easily see that 3 and 6 occur more than any other values.
Answer: 3 and 6

Questions Part 8 of 9 – Calculating the mode	*Helpful Information*
28.8 Calculate the range for the data sets below. a. 2, 6, 8, 2, 5 b. 5, 9, 3, 7, 11, 6 c. 3, 8, 9, 0, 6, 6, 3 d. 5, 8, 7, 6, 5, 4, 1, 1 e. 8, 1, 3, 16 f. 8, 1, 4, 5, 1, 0, 0 g. 5, 1, 1, 6, 0, 8, 6, 3 h. 1, 7, 1, 4, 5 i. 6, 9, 7, 8, 0 j. 9, 6, 9, 8, 3 k. 8, 1, 0, 8, 4, 5 l. 7, 2, 1, 0, 9 m. 4, 9, 3, 8, 11, 1 n. 5, 9, 2, 2, 7, 9, 6 o. 2, 9, 12, 3, 8, 6, 7, 1 *Answers* a. 6 b. 8 c. 9 d. 7 e. 15 f. 8 g. 8 h. 6 i. 9 j. 6 k. 8 l. 9 m. 10 n. 7 o. 11	The **range** is the highest value take away the lowest value. *Examples* **Question:** Calculate the range for the data set 2, 6, 8, 2, 5. **Thought process:**. Ordering the data gives us 2, 2, 5, 6, 8. The biggest value is 8 and the smallest value is 2. The range is equal to 8 - 2 = 6. **Answer:** 6 **Question:** Calculate the range for the data set 5, 9, 3, 7, 11, 6. **Thought process:** Ordering the data gives us 3, 5, 6, 7, 9, 11. The biggest value is 11 and the smallest value is 3. The range is equal to 11 - 3 = 8. **Answer:** 8 **Question:** Calculate the range for the data set 3, 8, 9, 0, 6, 6, 3. **Thought process:** Ordering the data gives us 0, 3, 3, 6, 6, 8, 9. The biggest value is 9 and the smallest value is 0. The range is equal to 9 - 0 = 9. **Answer:** 9
Questions Part 9 of 9 – Remembering the key statistical words	*Helpful Information*
28.9 Re-write the amazing song on the right in your workbook and celebrate learning the final skill within this book!! *Answers* Hey diddle diddle, the **median's** the *middle, you add and divide* for the **mean, t**he **mode** is the one that you see the *most,* and the **range** is the *difference between!*	The summary statistics can be remembered using the following song: ♫ Hey diddle diddle The **median's** the *middle* You *add and divide* for the **mean** The **mode** is the one that you see the *most* And the **range** is the *difference between* ♫